SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1803.—Vol. XL. LONDON, SATURDAY, MARCH 12, 1870. {STAMPED .. SIXPENCE. UNSTAMPED. FIVEPENCE

Original Correspondence.

THE SOUTH STAFFORDSHIRE COAL FIELD—No. II.

The following description of the workings of the Earl of Dudley's Lock's-lane pit, and other pits in the same field, is the continuation of the first article, which appeared in the *Mining Journal* of Jan. 22, describing the inundation which occurred on March 17, 1869, in the Thick coal workings of Lock's-lane pit:—

Workings of the Thick Coal Seam.—The Lock's-lane pits are situated in a trough, between two large faults, that to the north being 20 yards from the pits; an upthrow north 70 yards. That to the south is about 600 yards from the pits; an upthrow south 70 yards. In this trough three pairs of pits are in operation, including the Lock's-lane, on an area of 105 acres, equal to 35 acres to each. The principal part of the coal in Lock's-lane has been got in the first working, and the workings are now confined to barriers of coal and ribs and pillars. The main gate-roads from the pit are driven on the east and on the west sides, on the level course, about 7 ft. square, in the bottom coal; an air-head about 4 ft. square alongside, about 5 yards from the gate-road, and level with the top of the gate-road, with bolt-holes between every 20 yards. These form the means of ventilation as the roads are extended. At the distance of 170 yards east from the pit a gate-road to the south has been driven to the fault 600 yards; this is the full rise, about 5 in. per yard, and the coal was sent down by a self-acting incline for that distance; it is shortened as the coal is wrought back; at present it is 250 yards long from the turn to south. There are two roads; four tubs are run each journey; there are two 4-ft. drums, placed overhead, about 6 ft. apart; iron wire-ropes are used. A barrier, left for water, is being worked back here, 60 yards thick; it is got by driving "sides of work" into it. These sides of work are about 40 yards in a west direction, and 24 yards crossways, with a rib of coal 7 yards all round. In opening a side of work a bolt-hole, 6 ft. square, is driven 7 yards to west, and continued 8 yards further. Then cross-places are driven both north and south of this, together 24 yards. From this two stalls are driven westward; a pillar of 8 yards left between. After proceeding 16 yards this pillar is holed through from one stall to the other. After the stalls are driven 16 yards further west the pillar is holed through again 8 yards wide, which is the far end of the side of work. The air-head is made in the middle of the 7-yard rib left on each side, by which the air, after ventilating the side of work, returns through it to the main air-head. Only a limited supply of air is given to each side of work; otherwise, if much is given spontaneous combustion will arise from the small coal, black batt, and clod left in getting the coal.

SECTION OF THE THICK COAL SEAM.

		Ft.	in.	Ft.	in.	
	Cliff top.					
	Batt, 2 feet.					
Top coal....	1.—Spires coal, good	2	3			
	2.—White coal, good	4	3			
	Batt			1	8	
	3.—Heath coal, common	3	6			
	4.—Brassils, common	1	4			
Total		11	4			
	Strong cliff, with ironstone balls ..			1	6	6 to 16 feet.
Bottom coal	5.—Fine coal, good	1	9			
	6.—Veins coal, ditto	1	4			
	Batt			0	4	
	7.—Stone coal, common	2	8			
	Batt			0	6	
	8.—Patchells, inferior	1	8			
	9.—Sawyer, strong	1	7			
	10.—Slipper, best coal	2	8			
	11.—Benches, holing	1	8			
Total		13	4	4	0	
	Making a total top and bottom coal, 24 ft. 8 in.					
	12.—Black clod			6	0	

Gubbin ironstone measures.

It will be seen the seam, including the bands of batt, measures 28 ft. 8 in. in thickness in its least section on the north side of the mine; towards the southern fault the division between the top and bottom coals increases to 16 feet. The rule in a side of work is to drive out the bottom coal, first with the stalls and cross-holes to the far side, and in working back obtain the top coal, and as much of the ribs and pillars as can be got with safety. When this is done a dam is placed in the bolt-hole let into the coal, and made air-tight, to cut off any access of air to the side of work, and thus avoid spontaneous combustion. The band of stone between the top and bottom coal is peculiar to this trough, and is a further detriment to the proper working of the seam. Having regard to safety in working the coal, and to obtaining the whole of the coal in good condition, there is no doubt this seam would best be got in three divisions—Nos. 1, 2, 3, and 4 yards first (equal 11 ft. 4 in. in height), by long wall work, and filled up in the gob behind as much as possible with debris. After the lapse of a year Nos. 5, 6, and 7 beds, 6 ft. 7 in. thick, might be worked on the same principle; and after the lapse of another year the bottom coal remaining (7 ft. 7 in.) might be worked. On the west of Lock's-lane Pit, about 60 yards, another gate-road has been driven south to the fault 600 yards up, is now worked back to 250 yards from the bottom; coal sent down by self-acting incline, similar to that on the east side. A water barrier is being worked here also, 60 yards in thickness. The British Iron Company worked coal to the west of this by other pits, leased from Earl Dudley 12 years ago. This barrier is being worked, and the ribs and pillars left in the company's workings. The ventilating-furnace at the bottom of the drawing-pit is 5 feet long, 2½ feet wide. About 1400 tons of coal is raised per week of 5½ days at Lock's-lane Pit=255 tons per day. Nine horses are employed underground. The road is laid with angle-iron plates, 4 feet gauge. Wood tubs are used. Two butties contract to deliver the coal on the bank. Four kinds of large coal are made, which is separated underground and partly on the stage at bank, where it is filled into trucks; about one-third of the whole is slack. The Brooch coal is found in this pit, 60 yards above the Thick coal, but is not at all worked. It is understood there is no coal in this trough below the Thick coal, so far as trials have been made to prove the measures.

No. 15, Wallows Pits.—Two pits, 10 yards apart, in front of engine, 7 ft. diameter each, and walled with bricks and mortar. The engine at these pits—as before explained—assisted in pumping water during the inundation. There are two sets of 10-in. pumps from the depth of 180 yards; these are worked by two T-bobs, connecting-rods, and bell-cranks. The engine was used for raising coal during the day, and pumping water at nights, but is now disused.

No. 16, Wallows Pits.—Two pits, 7 ft. diameter, 12 yards apart, are sunk to the Thick coal seam, 110 yards deep; one upcast and furnace at bottom. Winding-engine, 18-horse power, horizontal cylinder, raises one skip in each pit, use three-linked rivet chains; raise 150 tons of coal daily.

No. 28, Wallows Pits.—Two pits, 12 yards apart, 110 yards to Thick coal, downcast and upcast. Winding beam-engine, 40-horse power, one skip run in each pit, raise 160 tons of coal daily.

No. 30 and 31 pits, near Round Oak Works. One pit in front and one at the back of the winding-engine, about 70 yards apart, 130 yards deep to Heathen coal; here it is 2 ft. 10 in. thick, 3 yards below thick coal. The winding-engine is an 18-in. cylinder beam-engine, 6-ft. stroke, with pinion and spur-wheels, two nitch rings, and rivet chains, but these are intended to be substituted by drums and round wire-ropes. Both pits are fitted with a cage in each, and wood conductors. About 40 tons of Heathen coal is raised daily, the pits are only opening out; the coal will be worked on the long wall system. The Gubbin ironstone is got above; the white ironstone is 12 yards below. The Thick coal is worked above this in the first working. Water pit, 135 yards deep, near the above. Pumping-engine, beam resting on the front wall; cylinder, 36½-in.; 8-ft. stroke, 5 to 15 lbs. steam pressure, condensed; three boilers, plain cylindrical. There are two sets of pumps, 14 and 14½-in. buckets, 7-ft. stroke; these are worked by means of bell-cranks, connecting-rods, and two T-bobs. Pinion and spur-wheels in the proportion of 1 to 2. The engine has a large fly-wheel, and is very effective; this type of water engines is much in favour in South Staffordshire for moderate depths, 120 yards and under. There are six other plants of pits at the Earl of Dudley's Wallows Colliery—viz., No. 1 pits, downcast and upcast, 120 yards deep; the Thick seam is worked in whole. No. 5 pits, downcast and upcast; the downcast is used as a water pit; are working ribs and pillars drawn at the upcast. No. 14 pits, downcast and upcast; 110 yards to the Thick seam; ribs and pillars being worked, drawn at the downcast. Nos. 23 and 24 pits, three pits sunk to the Heathen coal, 116 yards; one a water pit, one downcast, one upcast; the Heathen coal and gubbin ironstone being worked. No. 25 pits, downcast and upcast; the white ironstone raised at both. No. 26 pits, downcast and upcast; the ribs and pillars of the Thick seam, worked from both.

SLATE QUARRIES IN DENBIGHSHIRE.

At a distance of five miles from Llangollen the quarries of the Llangollen Slab and Slate Company are reached. The slate quarries are situated on elevated ground at Foel-faen, from which an extensive view of the country to the north and west is obtained, and the sea beyond; they have been worked for a period of 40 years. There are four quarries opened at Foel-faen; only two of these are now in operation, and 160 men and boys are employed in quarrying, splitting, and squaring the slates. The same vein of slate is worked in the four quarries; its width is about 120 yards, but the whole of this width does not furnish marketable slate; some of it not possessing the requisite quality of lamination is carried to the spoil banks. The produce of these quarries is of a dark slate colour, though not equal to Carnarvon slates in durability and appearance; they last ordinarily about 50 years. The slate beds are now worked at the depth of 120 yards from the highest point of the quarries; the upper 50 yards or so is considered inferior in quality, but must be worked in order to get access to that below. In general slate cleaves better from the deep part of the quarries, and can be produced thinner, more level, and of better quality than from those parts near the surface, and this is so proved at Voel-fen, an improvement taking place downwards. The dip of the vein appears to be about 70° from the horizontal northward; the cleavage of the slate is in the same direction. From the bottom of each quarry a tunnel is driven out to the hill side, which serves for drainage and bringing out with horses the produce of the quarries—slate and debris. The hills from Llangollen to these quarries are composed of clay-slate, belonging to the Cambrian formation. The clay-slate is used for building houses in these parts, in the absence of better material. No fossils are found at the quarries.

Slate quarries, on another vein, are opened at the back of Foel-faen; these are now discontinued, partly because the slate is worked at a disadvantage, at the back instead of the face. Two miles from the slate quarries the slab quarry at Clogir is situated; this is one quarry, and opened to a great extent; it is, no doubt, a valuable property. The vein of slate slabs is about 200 yards wide, running east and west, as in the slate quarries. A tunnel is driven below the present bottom of this quarry, in order to bring out the produce and for drainage. This tunnel has not yet come into use, but will save the slabs being lifted by cranes and brought out at a higher level. About 60 men and boys are employed at Clogir Works; 20 or more of these are engaged in sawing the slabs by hand to the required size. There are two planing-machines and four sawing-machines erected; these have been worked by a 12-in. horizontal steam-engine, but at present they are not in operation. The sawing is done as cheaply by hand. A slab sent from this quarry to the London Exhibition of 1862 measured 19 ft. 8 in. by 10 ft., and 3½ in. in thickness. Slabs 16 ft. square are obtained, but cannot be transported away from the quarry of that size. One slab 12 ft. by 4½ ft., and 2 in. thick, has lately been made. Also a cistern of whole slabs, 9 ft. 10 in. by 4 ft. 10 in., and 5 ft. deep inside, the side slabs 2½ in., the bottom slab 3 in. thick. After being sawn, as described, the slabs are taken to the works at Pentre-velin, about one mile from Llangollen.

At these works there are seven planing-machines and three circular saws, and 30 men are employed. The slabs, as a rule, are all planed, to render them level, and of the required thickness. Rotary saws of 12 in. diameter and under are used, according to the thickness of slab to be sawn. This machinery is driven by a water-wheel 14 ft. in diameter, 9 ft. wide, equal to 14 horse-power. These slabs do not cleave at any part, as some of the Carnarvon slabs do; a large proportion is sometimes required to be taken off by planing. For regularity, size, and soundness the Llangollen slabs rank with the best in the Principality. Some beds in the Clogir Quarry contain numerous fossils, bivalves and others, rather indistinct. I was informed more perfect specimens of encrinites and bivalves are sometimes obtained.

The slates and slabs are conveyed away from the quarries on a contour and incline railway, 3-feet gauge, in wagons with 18-inch flanged wheels; these are drawn by horses on the contoured parts of the railway. There are two steep self-acting inclines on the main line, and another from the slab quarry to the main line. These inclines are each fitted with a large drum, wire ropes, and double line of road. The terminus of this railway is at Pentre Velin, where the company's planing works are situated, before referred to.

From Pentre Velin the slates and slabs are sent away either by the Great Western Railway, or by the Shropshire Union Canal, which extends to these works. They are sent to all parts of the kingdom. The slabs are used extensively for water cisterns, flagging inside of houses, and door steps. Both in the slate and slab department a depression has been experienced for some time, the demand being much influenced by the activity or otherwise of the building trade.

THE BRYMBO IRON WORKS, DENBIGHSHIRE.

Sir,—The Brymbo Iron Works have been in operation about eighty years, and were established by the celebrated John Wilkinson. The Brymbo coal field has been worked from a very early period. In 1780, we are informed that iron was smelted at Ffrwd, by Wilkinson, a blowing-engine being used for this purpose, the first of the kind erected in Britain. He also possessed a large cannon foundry at Bersham, in the same locality, where most of the cannon used by the British in the Peninsular war were manufactured. The first Boulton and Watt engine erected in Cornwall was sent from the Brymbo field, being conveyed on wagons by road, a distance of about 300 miles.

An abundant supply of coal and ironstone of excellent quality in the Brymbo field has made it an advantageous position for iron works. Railway communication with the Shrewsbury and Chester line was only obtained about 20 years ago; previous to that the conveyance of material and manufactures was on common roads, so that the iron works must have been carried on at a great disadvantage. The Brymbo iron works are now possessed by Messrs. W. H. Darby and Co. There are two blast-furnaces, one 47 and the other 50 feet high; both are in operation; hot air at a temperature of 700° is blown into them. The native ironstones comprise pin stone, black stone, crank, and brassy stone. The native ironstones, mixed with Lancashire hematite, Spanish, and other ores are used for smelting. Coal and coke are used as fuel, principally the latter. Nearly the whole of the coke is made on open hearths, without chimneys, which plan requires the coal generally to be large, and takes nine days to complete the coking. About twelve ovens are erected for coking slack. The slack is first washed by a machine; each oven has a chimney, and the coke is withdrawn by a fixed crab and cradles. The limestone used for fluxing is calcined in a kiln before its introduction into the blast-furnaces, and is the mountain limestone, obtained from the Minera Quarry; it is of remarkable purity, containing, according to analysis, 98 per cent. of lime. The make of pig-iron is about 125 tons per week from each furnace. There are three hot-air stoves for one furnace, the pipes of which are of the corkscrew form, 9 inches diameter, and two stoves for the other furnace, the pipes in which are of the horse-shoe form, oval in section. There are three tuyeres to each furnace; these are formed of spiral pipes, cast in metal, for the circulation of water. One blowing-engine is erected, a beam condensing-engine, without fly-wheel, 50-inch steam cylinder at one end, and 90-inch blowing cylinder at the opposite end of the beam; it goes regularly about 15 strokes per minute; the maximum is 18 strokes. The pressure of the blast is 3 lbs. per inch. The stoves, and the boilers in part, are heated by the waste gas, drawn from the top of each furnace by means of chimney draught. The gas is withdrawn by the well-known bell system, which is patented by Mr. C. E. Darby, one of the partners in the Brymbo Company. The gas tubes are 3 feet and 3½ feet in diameter, of wrought-iron, without any interior lining. The bells are suspended from the top of three iron legs; one bell may be taken out and another put in its place in the space of two and a half hours, a joint being provided for this purpose. The gas is used for heating the whole of the stoves, and for four of the boilers attached to the blast-engine, one boiler being fired with coal. There is one high chimney in connection with the boilers, and another with the stoves. At the Brymbo furnaces iron of a high quality is produced, and is varied according to its requirement, the native ironstones, no doubt, favouring the quality. In the foundry, adjoining to the blast-furnaces, 100 tons of castings can be turned out per week. Heavy castings, girders, pumps, pipes, &c., are extensively made. There are also a machine and fitting shop, furnished with six machines, smiths and carpenters' shops.

The Brymbo Collieries are situated on the dip side of a fault, which throws down to the west 150 yards; this fault runs underneath the works, and the colliery workings are bounded to the west by another downthrow fault. The seams of coal at present worked are the following, in order:—

The Two-yard coal	5 ft.	6 in.	.... Furnace and house coal.
The Crank coal and ironstone	2	4	.... Best house coal.
Brassy coal and ironstone	5	0	.. Best furnace coal, used raw and coked.
The Black bed coal and ironstone	1	6	.... Smiths' coal.
The Main coal seam	6	0	.... Best steam coal, cokes well.

The Drowsal and Powell seams occur above these; the former is stated to be the best in the list for house and other uses, but owing to its variable thickness, and the bad roof over it, this coal has been little worked. There are three other seams occurring under the main coal, these are the Little Yard, the 4-ft., and the 2 ft. 9 in. seams, and are as yet unworked.

There are four principal pits from which coal is raised; the quantity varies from 300 to 400 tons per day, and several pits from which ironstone is raised to the extent of 1600 tons per month. The Furnace pits, near the works, consist of one downcast and one upcast, 20 yards apart, 183 yards in depth. The winding-engine is a beam non-condensing engine, inside the house, 20-in. cylinder, 4-ft. stroke, on the second motion, and it raises, with two flat wire-ropes, one carriage in each pit, each carriage runs on two wood guides, and contains one tub of coals. The ventilation of the mine is caused by a furnace, and is further accelerated by the escape steam from an underground engine. The pipes to supply this engine with steam are taken from the boilers on the surface through the upcast pit. The engine is placed near the bottom of the pit in the Main coal seam, and hauls from a dip plane 900 yards in length; the dip of the plane is about 4 in. per yard eastward. The Two-yard, Crank, Brassy, and Main coal seams are each worked at these pits, cross-measure drifts from the Main coal reaching to the other three seams. The Cornish pumping-engine erected at the upcast pit is a 52-in. cylinder; it raises water from the depth of 200 yards in three sets of pumps, the lowest being a bucket, the middle and upper forcing sets, 13 inches in diameter. As a steam coal, Brymbo Main coal is on the British, French, and Spanish Admiralty lists; it is used also by the Peninsular and Oriental and by the West India Mail Companies' steamers.

Ffrwd Iron Works, two miles distant from Brymbo, are carried

on by Messrs. Sparrow and Poole. There two blast-furnaces, both in operation, about 54 ft. high, hot blast is used, and the gas from each furnace is utilised for heating the stoves and boilers. From one gas is withdrawn by means of a bell, and from the other by eight pipes from the interior, connected with a chamber all round outside the furnace, all these being of wrought-iron.

At the BROUGHTON IRON WORKS, near Wrexham, pig-iron from various parts is purchased, and manufactured into iron and steel. There are twelve puddling and two mill-furnaces, one puddling forge, helve hammer, a 14-in. rolling-mill, and a 10-in. guide-mill. These are driven by a 60-horse beam-engine, three furnace boilers supply the steam; these are heated by six furnaces.

March 8. MINING ENGINEER.

EDUCATION OF MINERS.

SIR,—I was much pleased to see in last week's Journal a letter from Prof. Hunt, referring to the education of miners in Cornwall, and being a Cornish miner, and having some knowledge of the Association to which he refers, I have no hesitation in endorsing all he said. The Miners' Association of Cornwall and Devon is, no doubt, one of the best institutions for the education of the working miner now existing in the two counties, and I deem it a very great pity that it does not meet with a more liberal support from mining gentlemen in general. I think, Sir, that if the eyes of the mining speculator were opened to see the importance of keeping alive this Association, and giving it power to spread itself over the entire country, the committee would not be so burdened as it has hitherto been with an almost insufferable debt. Its present existence is, no doubt, due to the energy and indefatigable perseverance of its hon. secretary, Mr. R. Hunt, to whom unbounded praise is due for the interest which he ever takes, not only in the improvement of mines, but the miner.

This Association confers a benefit, first, on the working miner, and secondly, on the mine adventurer. It must be borne in mind that miners' children in general have not the privilege of obtaining an education from elementary schools that will qualify them for the various posts to which they may be called, for many have to leave school when 8 or 10 years of age, to work in the mines or elsewhere, and afterwards they have to obtain knowledge by the dint of their own powers after an arduous day's work. Where the Association is at work those powers are assisted, and many a miner thus aided is now filling posts of importance in various parts of the world, to the credit of themselves and employers. It confers a benefit on the adventurer, because it gives him the opportunity of putting the right man in the right place to conduct his mining operations. It is a fact patent to all, that a mere theorist in mining, whatever his other attainments may be, is not *the* man to have the care and supervision of mines. This Association, then, prepares and qualifies the *experienced* and *practical* miner for the situation which otherwise could not be undertaken by him; and mining companies have the benefit of sound *theory* and extensive *practice* in the same man to manage their mining affairs. The inference which may be drawn from these facts is this—a little money spent in support of this Association will assuredly return a profit to the investor. JOHN ROBERTS.

Llanidloes, March 10.

IMPROVED PROCESS OF IRON AND STEEL MAKING.

SIR,—The advantages of Henderson's Patent Fluo-Titanic Improvement in the Manufacture of Iron and Steel are—

1.—Iron of the highest grades as to ductility, strength, and purity may be produced from ordinary qualities of cast-iron.

2.—Manual labour is unnecessary, as the conversion of cast-iron into wrought-iron or steel is caused by the spontaneous reactions of the fluxes with the impurities of the iron, at high temperatures.

3.—Cheapness, as compared with any other process, as the iron in the titanic ore during the conversion is rendered metallic, and is incorporated for the most part in the metal, and it becomes equivalent to the same weight of pig-iron.

4.—The facility with which steel may be produced, by merely varying the grade of the pig-iron used.

5.—Saving of fuel compared with puddling or analogous processes.

6.—Greater production from a given amount of capital invested.

As its name implies, this invention relates to the combined use of fluor-spar and titaniferous iron, or titaniferous iron ores, for removing carbon, silicon, sulphur, and phosphorus from crude cast-iron, and may be applied in any process for production of wrought-iron or steel. Several modes of application have been tried with success. In one granulated cast-iron was charged into a furnace in admixture with titaniferous iron ores and fluor-spar, or fluoride of calcium, both pulverised. When the iron melted the heat dissolved the fluor-spar, which combined with the titanic acid in the iron ore, and by reason of the affinities of these two substances for carbon, silicon, sulphur, and phosphorus these substances were taken from the iron in the form of vapour and slag, leaving the resulting metal to be hammered or rolled as wrought-iron or steel. Another method is to run the molten cast-iron direct from the hearth of a blast-furnace into a converter or refining-furnace, in which there has been placed fluor-spar mixed with titaniferous iron ore. If they have been subjected to the heat of the furnace for a considerable time they will become viscid, and remain at the bottom during conversion, or they may be applied in a plastic state, as a lining, and dried, and the cast-iron may be run in upon them.

By this invention almost any desired quality of iron or steel may be produced by merely adapting the proportions of fluor-spar and titaniferous ore to the character of the iron used. White iron, or that in which the carbon is combined, being preferred where wrought-iron is required, and graphitic cast-iron where steel is wanted; in the latter case the proportion of the fluxes may be graduated so as to remove the silicon, sulphur, phosphorus, and all the surplus of carbon over that required to form steel, which remains in the steel as combined carbon. Manganese may be used, or spiegeleisen poured into the liquid wrought-iron; or the use of chrome ores, applied in different stages of the process, to give the requisite degrees of hardness. I have used 7 cwts. of Norwegian titanic iron ore and 3 cwts. of fluor-spar to produce ingots of wrought-iron. The analysis of the pig-iron used, which was white Cleveland (English), and of the ingots produced from it by my invention, are as follows:—

PIG-IRON.		INGOT.	
Carbon	3·3710	Carbon	Traces.
Silicon	1·8139	Silicon	None.
Sulphur	0·3620	Sulphur	0·0620
Phosphorus	1·3810	Phosphorus	0·1399
Iron by difference	93·0721 = 100·0000	Titanium	0·0215
		Iron by difference	99·7766 = 100·0000

All practical ironworkers are familiar with the fact that about 3-10ths of 1 per cent. of phosphorus and sulphur are removed by subsequent working, and it will be evident to them that in this respect the metal produced by this invention will compare favourably with any produced by any process.

It will be obvious from the foregoing that almost any pig-iron produced in the large iron manufacturing districts will, by this invention, be made available for the production of steel for general purposes. Titaniferous iron ores are in some parts of the world considered almost valueless, and, as a rule, may be had very cheap, as compared with other iron ores. The quotations have been less in the North of England shipping ports on the North Sea than for the hematites of Lancashire and Cumberland. They are to be had in great abundance in Canada, Norway, Italy, New Zealand, and the United States. Fluor-spar is found in France, England, Germany, and the United States, and in other parts of the world, and is a cheap product.

In applying my invention, I have found it advantageous to use lime, or limestone, or magnesia, or magnesian limestone, over the ordinary lining of the furnace; and to place a thin layer of scrap iron over the lime or magnesia of sufficient thickness to last during the greater part of the conversion, and upon this to charge the fluor-spar. I propose to modify Eck's reverberatory gas refining furnace, to adapt it to my invention, or to use some other that is equivalent to it, such as T. Grocbe's gas re-heating furnace, wherein it will be possible to have the part leading from the hearth to the chimney of ollow iron, with a circulation of water in it, also the chimney arranged in a similar manner. I should prefer to have the hearth-sole or crucible of the furnace made movable, similar to Boccard's cupola furnace, but without the passage for the air-blast around it, as is the case in that apparatus; and by having several of the removable hearths, the work of the furnace may be made continuous, no stoppage will be required for repairs. A furnace like Eck's, of the usual size, will convert about 1 ton; and the time will be about one hour from the time metal is charged for the conversion, and melting, and casting. The conversion of the iron, after it is melted, lasts but from 20 to 30 minutes; and 30 minutes should be allowed for charging, melting, and drawing off the metal. JAMES HENDERSON.

30, *Broadway, New York, Feb.* 16.

COLLIERY MANAGERS—"*IS* THE HORSES SAFE?"

SIR,—The overman who uttered these memorable words deserved the Victoria Cross. I will show you what, in some small "tuppiny" collieries, he is expected to do, what he does, what he gets for it, and what *is* his reward.

What he is expected to do.—He shall carefully examine, with a safety-lamp, the state of the ventilation in all the working places and travelling roads, and ascertain that they are in a safe condition before each working person goes to his place; and if he finds any part unsafe, he shall put up in some conspicuous place, and at a sufficient distance from the point of danger, a signal-board, indicating danger. If he finds the place safe, he shall put up the safety signal. If any part is found unsafe, he will put up, in some conspicuous place, at a sufficient distance from the point of danger, a well-known signal, beyond which signal or board no workpeople shall pass without his directions. He is expected to go down the pit at such a time in the morning that he will do all this, and be able to be at the shaft before the men descend to their work. Let us take a pit where the seam is 3 feet thick, the roads 45 inches high, the levels in 400 yards on each side of the shaft, the winning out places 150 yards to the rise, and worked by long wall, with road 14 yards apart. The fireman or overman is expected to travel 6000 yards, or 3½ miles, with his body doubled, all alone, with the dim light of a Davy lamp, and be out before six o'clock in the morning, and then to work all day. Let any honourable member, be he "a youth of 50, or any other man," try to walk ½ mile in this humble position in broad daylight, instead of the "lonely round" of the fireman, and he will faintly realise what the fireman is "expected to do." But then he does not do it, because it is impossible that he can do it, and his master knows it; and this brings me to the next head.

What he does.—He knows pretty well by experience where firedamp is likely to be, and instead of going through every road, as the special rules direct, he takes it for granted that the other places and roads will be safe, and he only goes to suspected places; and if he finds these places right, he hastens back to the pit bottom, and "gets the men down," and in this way, instead of travelling 3½ miles, he does not travel over one mile. There is no deception on the part of the fireman. His master is perfectly aware that he does this; at least if he takes the trouble to measure his plan, he will see that it is utterly impossible that the man can do more than he does; and then, after this is done, the man is expected to hang on all day, to keep the pit at work. Long experience with these men has shown me that, as a rule, they are most faithful servants in the mine. They are, as a rule, ready at all times, and are always in the front of all danger—ready to do what is wanted, and the first to do it.

What he gets for it.—For all this work, for being the first man out in the morning, for having all the responsibility of detecting firedamp, for standing frequently the "jibes and snash" of the men, the fireman—the poor "doggy"—gets from 25s. to 40s. a week. It is a stepping-stone, when there is ability, to a better place, where he will not have so much running, and so he keeps at it. And now—

What is his reward.—I wish I could say it was otherwise, but here is frequently his reward. I have said that he does not go through every road, because he has not time to do it. It is well known he does not. He only goes to those places where gas is suspected, or where he expects to find it, and so some fine morning it is found that gas is found where he did not expect it, and a man goes in and gets burned, and the owner says—"It is not my fault, for I know nothing about it; I have appointed an efficient manager." The efficient manager says—"I appointed a fireman or doggy—a competent man." The poor doggy says—"I did not expect to find fire there, and I did not 'look it.'" "Well, but," says the magistrate, "you have neglected the special rules, which it was your duty to have obeyed, and in consequence of your neglect this man has been burned, and I fine you 10*l.*, or three months' imprisonment." Verily, he has his reward!

D.

PREVENTION OF COLLIERY ACCIDENTS—No. II.

SIR,—In concluding my previous letter (published in the Supplement to the Journal of Feb. 19) I stated what, in my opinion, was the best class of engines for raising the minerals from the bottom of the pits to the surface, when the depth was between 200 and 300 yards. The same description of engine, only proportionately larger, I consider to be the best for greater depths. At some of the deepest pits in this country they have large single engines; for instance, at Monkwearmouth, where the pits are nearly 600 yards deep, they have a vertical engine, with a cylinder 65½ in. diameter, and working a 7-ft. stroke; and also at the Big pit, Hanley, the property of Earl Granville, where the pits are about 500 yards deep, they have, I believe, a single vertical cylinder, 60 in. diameter. These pits seem to work satisfactorily, but I am sure they would work much better, and at a less cost, were a pair of engines coupled used, for they have the difficulty to contend with I before mentioned—the engine getting on a dead centre. If they do not stop with the engine on a centre it often happens that the wire-rope, which is stretched or extended by the cage descending at such a rapid rate, and on the weight coming to a stand at the bottom of the pit, the wire-rope contracts and moves the winding-drum, and, consequently, the engine, bringing it to a centre. When this is the case (as it has to exert its greatest power in starting again, for there is the whole weight of the rope and the loaded cage at the bottom of the pit to be raised, at a time when the other cage is light, and the other rope is wound on the drum, so that there is hardly any power in the balance) the engine has to be taken back a little, and started to take a sort of run at its work. This, of course, must be very injurious, as it gives a great shock to the whole of the machinery. Another thing is you cannot, if need be, stop or start a single engine at any exact place in the pit shaft, as the least movement where the drum is large makes a great difference, whereas with a pair you can stop almost to an inch, and start again with perfect ease. These facts, when properly considered, I should think would induce any colliery proprietor, if not to dispense with his present awkward engines, at least at a new sinking to put down engines to work direct acting, for, in reality, the cost is very little more than that of an engine geared to the winding apparatus, for the fly-wheel, crown-wheel, and pinion, their shafts and carriages, and race-plates, as well as the brickwork that supports them, are dispensed with; and a second engine is of very little greater cost than they are. It is made compulsory by Act of Parliament that every engine used in collieries for winding purposes should be supplied with a break; those in general use for small engines are worked by hand or foot, and consist of a long lever, keyed on to a round shaft. From this are worked other levers joined to a wrought-iron strap, lined with wood curbs, and working on to a large flanged pulley fixed on the winding-shaft. The levers are so arranged that when the first lever, or handle, is pulled the curbs tighten on the pulley, and arrest the motion of the engine. These hand-breaks are often placed against a wall, or a little out of the way of the engine-driver. The consequence is that when the engine is hardly up to its work, or has a greater load than usual, the ascending load overgets the power of the engine, and commences to descend. The driver cannot then loose his engine, and both his hands are employed, so he has, by means of the reversing-lever, to hold the valve over the port where the steam is exhausting, and use the steam as a break. The steam is often compressed in this way till it arrives at a pressure of 400 lbs. to the square inch; so it will be seen that this is a dangerous experiment, for if everything is not strong and firm a large amount of damage might be done. I consider that all winding-engines ought to be supplied with steam-breaks, self-acting—that is, worked by the indicator, and also with a connection close to the hand of the engine-driver, so that it can be worked by him in any emergency. There are many patents out for steam-breaks, and I think one of the best is Mr. Wright's, of Dudley. It consists of a small cast-iron cylinder, in which are two pistons, each connected by levers to a wrought-iron strap, working on a break-pulley. When the steam is turned into the break it rushes between the two pistons, sending the one up and the other down, and so tightens the wrought-iron strap. The steam escapes through small holes made in the circumference of the cylinder. There is always a small jet of steam conveyed from the exhaust-pipe of the engine, by means of a gas-pipe going into the cylinder, to keep it warm. If it were not so, when the break was put to work in cold weather nearly the whole of the steam would be condensed.

By far the most effective, cheapest, and simplest break I have yet seen is fixed to an engine working one of the Earl of Dudley's pits, and made by a working fitter of Brierley Hill, named Vaughan. It has a small cylinder fitted with a piston, which has its rod working through a gland in the cylinder cover at the front, there being no cover required for the back, to the end of the piston-rod is connected a long rod joined on to the levers attached to the strap which surrounds the break-wheel. The break is worked by means of an appliance similar to that used for ringing a bell, to warn the driver that the skip or cage is approaching the top, and which is in use at most pits in South Staffordshire; it consists of two small bevel-toothed wheels, one fixed on the end of the winding shaft, and working into another fixed on a small round rod; on the other end of this rod is placed another small wheel, working a similar one on the end of a horizontal screw; on this screw is placed a straight piece of iron, tapped with the same thread, but made to work very loose, so much so that when the screw revolves the iron hangs down and traverses from one end to the other; at the extremities of the screw are two journals, or necks, without thread upon them, which work in two small carriages fixed to a wrought-iron plate on the wall of the engine-house; just inside these carriages are two pieces of iron, having their ends bent at right angles pointing to each other, and parallel with the screw. When the engine starts the screw revolves, and is so geared that as the load reaches the top of the pit the loose piece of iron arrives at the end of the screw, and is taken round by one of the bent pieces of iron, and comes in contact with a piece of spring steel fixed on the wrought iron wall-plate; at the end of this piece of steel is a catch holding a weighted lever attached to the throttle-valve of the engine; as the piece of iron comes against the steel it pushes the catch back, and releases the weighted lever, and so turns off all steam from the engine. At the next turn round of the screw the piece of iron is again caught up, and releases by means of another piece of steel and catch a similar weighted lever to the other, which this time opens a cock, and admits steam into the cylinder of the break, sending the piston back, working the levers and tightening the curbs or strap, and bringing the engine to a dead stand. There is a small tap in the break cylinder, which emits the steam after it has operated, and allows the break to go back to its former position. With this break I have seen an engine started at full speed, and left entirely to itself; the break acted perfectly, and brought the engine to a dead stand at the proper time. The break is also supplied with a steam-tap, under the command of the engine-driver. Where this break is used there is no necessity for disengaging gear to prevent overwinding; and there is one advantage with it, and that is, no trouble to put it right after it has acted, as is the case with disengaging gears, which all let the rope come over the pulley, and there is some amount of trouble required to get it back. In every engine-house should be placed a good steam-gauge, and also an indicator, to show the position of the load in the pit-shaft. The best in use is that with a clock-face, with the various depths marked upon it, and having a finger to show the exact spot. The best and safest boiler, in my opinion, used for mining operations is the ordinary cylindrical egg-ended, or wagon boiler; it has many advantages over the Cornish, or tubular boilers, although they may be a little more economical in saving fuel (this can be made up in other ways), but this is not of much importance where they are drawing coal, although it may be at ironstone and other mines, where they have to carry it from other places. The above-mentioned class of boiler is easily inspected, cleaned out, or repaired, which is not the case with those having tubes running through them.

I have known Cornish boilers to be put in at collieries in the Black Country and have to be taken out again, as they could not raise steam enough. The cause of this has been that the slack or small coal used has been bad, and full of bats, and there not being near so much room under the grate as in a wagon boiler the draught is less, and the person in charge has been unable to keep his fire-bars cleaned out, which is necessary for the proper generation of steam. Every boiler should be supplied with two safety-valves, and also a water-indicator, furnished with a steam-whistle, to warn the engineman when the water is getting low. There are hundreds of patent safety appliances to be attached to boilers, which it would be almost useless for me to attempt to enumerate; but there is one that deserves notice, and it is that of Messrs. Hughes and Sellers, Nottingham; it accomplishes two important objects, that of easing the pressure by acting as a safety-valve, and reducing the generative power by allowing steam to blow down on the fire when the water gets low, which it would soon extinguish were the feed water not turned on, and would by that means prevent injury to the bottoms of the boilers or crowns of the tubes, as the case may be. Above all things, I would impress upon all employers of steam-power the importance of taking all necessary precautions to prevent those disastrous explosions so prevalent last year; if they do not, Government will find it incumbent upon them to employ inspectors, which act will not be much relished. I would advise all proprietors to consume their own smoke, not only to do away with the nuisance, but for the sake of economy. There are many patents for accomplishing this object, but the only ones worth anything are those that work with a gradually closing door, or are so arranged as to let a certain quantity of air in after firing, and then to gradually stop it. With an apparatus of this sort from 20 to 25 per cent. of fuel may be saved; for if we consider the matter chemically we find on an average 100 lbs. of coal made up of 80 lbs. of carbon, and 5 lbs. of hydrogen; the other 15 lbs. is made up of other gases, clay, &c. The hydrogen in the coal exists in a sort of combination with the carbon; and when heated goes off as carburetted hydrogen, a gas consisting of one part hydrogen, and three parts carbon. Then, if 100 lbs. of coal contains 5 lbs. of hydrogen, that combines with 15 lbs. of carbon, and makes 20 lbs. of carburetted hydrogen, or ordinary coal gas, the produce of 100 lbs. of coal. Now, this gas requires for its proper combustion a certain quantity of air, so as to supply a requisite quantity of oxygen to convert the hydrogen into water, and the carbon into carbonic acid; if the air is insufficient—which is always the case at firing if the doors are not left open or some air-way provided, as the extra fuel coming on the fire makes a thicker layer for the air to come through from between the bars, and also lessens the rarefaction in the chimney or stack, and so injures the draft—the hydrogen, having a stronger affinity for the oxygen than the carbon, seizes on its requisite quantity, and so leaves the carbon, when mixed with the hot gases, to ascend the chimney in the form of smoke. After perusing the above it will be seen that a certain quantity of air is required at the time of firing, and then to be gradually cut off, for if the air is continued after it has accomplished its object it only cools the boiler, and proves a detriment to the raising of steam instead of a facility. The apparatus that provides for the above requirements is the proper one, and if rightly constructed will consume smoke and save fuel, while those that have a continual draft may consume smoke, but will be worked at a sacrifice of fuel. An apparatus made from the ideas of Mr. Smedley, Matlock Bank, fulfils, I believe, the foregoing requirements.

Dudley, March 2. COLLIERY ENGINEER.

THE COPPER TRADE.

SIR,—I fully coincide with the opinion expressed in last week's Journal on the letter of "Nosiris" as to the permanent cheapness of the price of copper, but there yet exists a monopoly of smelters and agents for the sale of sheet copper, by which the price is enhanced to the English public from ¼d. to ½d. per lb. I refer to the difference in the price of sheet copper for export, and copper sheets for sheathing, which can be bought at fully 3*l.* per ton below the prices charged to the English manufacturers either in Manchester, Liverpool, or London. Why the British manufacturer of copper goods is mulcted with this imposition over and above foreigners I am at a loss to know, unless it is that the copper smelters think the home trade is in such a flourishing state that we can afford to give the foreign manufacturers of copper wares the 3*l.* per ton to enable them

to compete with us in our own markets, and still further depress the home copper trade; but perhaps some of your enlightened correspondents or smelters can give a satisfactory explanation why this practice exists. This system of monopoly if carried on much longer will enable the foreign producers of sheet copper to undersell the English, of which there has been a few instances lately in the London market.—*East-street, Leeds.* A SUBSCRIBER.

THE POSITION OF COPPER.

SIR,—The second letter of "Nosiris" consists almost entirely of declamation, and fails to add *one fact* towards the elucidation of the subject we have in hand. I think, too, we have some right to tax him with contradiction, for in his first letter he dwelt largely on the extent of Chilian supplies, because it then suited his assertions, whilst now he bids us to disregard these supplies altogether, because, I conclude, he finds them becoming inconveniently moderate for the support of his opinions. He warns your readers, I see, against allowing the largeness of existing stocks to be explained away, and yet it will be perceived he still avoids any attempt to rebut the facts and figures given in my letter in the Journal of the 19th ult.

In another part of last week's Journal "Nosiris" first letter is supported in a manner equally uncalculated to carry conviction to anyone who looks simply to facts and to sound argument. This writer, however, suggests to me (what I had previously overlooked) the very striking analogy between the present position of copper and that of tin, when the latter was selling at 75*l.* per ton. It was then the custom to assert of tin (as it is now of copper) that there was an overwhelming supply, that it could be produced in Banca at little over 40*l.* per ton, that English mining was no criterion of Banca mining, &c., and that, consequently, we were to see still lower prices, and a *permanent* depreciation. How fallacious these predictions were is now seen by "the inexorable logic of facts"—120*l.* per ton to-day for Banca tin, after touching 140*l.* Yet with a more clear appreciation of the true position of tin these very extreme fluctuations might have been avoided, and the best interests of producers, manufacturers, and consumers have been served.

The object of my letters is to assist, if possible, in avoiding a similar issue for copper. If the position "Nosiris" is taking up is sound, he is bound to show us that *at present prices here* a sufficient quantity of copper can be produced *at a fair profit* to meet the world's growing requirements.

The only tangible fact he has so far adduced is that of a Chilian mining company, and the great depreciation in the shares of that company, which I submit tells directly against his conclusions. Until, then, "Nosiris" can afford us more convincing facts, I must still maintain that our existing stocks of copper, though full, are by no means excessive, and that if measured by their present money value they are really very small—that to-day's extreme depreciation (so far as facts and analogies are worth anything) must eventually end in an equally extreme advance; and that the longer copper remains at its present very low price, the greater and more sudden must be the ultimate rebound.

I still hold, too, that with more "middle-men" the evil of very extreme fluctuations might be largely mitigated, and I may add that this view has the support of Mr. McCulloch and other political economists.—*March 10.* INVESTIGATOR.

LEAD MINING IN FLINTSHIRE.

SIR,—The stimulus given to mining enterprise by the wonderful success of the Van, we rejoice to see, has extended to this county, and it can be no other than gratifying to the well-wishers of such enterprise to find capital flowing into so legitimate a concern as the West Pant-y-Goff Mine. This undertaking embraces every element of success, and a spirited development cannot fail to result in a mine great and lasting, a blessing no less to the deserving proprietary than to the district in which it is situated. Contrary to the custom that has been too much in vogue of late years, the promoters pin not their faith alone upon the *deeper* development of one lode, an operation too often undertaken under every disadvantage, and leading generally to disastrous results; but they propose driving boldly north and south, with the object of proving as fine tracts of virgin ground as are to be found in the county, into which two well-known lodes are known to run—the celebrated Pant-y-Goff on the one side, and the Bryncoch on the other, both of which are intact to surface, and there is very little doubt that, under the able management of him who, we hear, is to conduct operations, both will be found a source of great profit. With such undertakings as this is, I expect, will dawn a new era in Flintshire mining, an era as distinguished by success as the late one has been by failure.

The district under notice is likely shortly to be the centre of unusual interest, and to rank, as of yore, as one of the most profitable in the kingdom, not only from the development of the before-named mine, but also from working the remarkably promising mines adjoining—the Fron and the North Hendre Mines. Capital has at last been brought into the former, I am glad to learn, with the object of prosecuting the valuable discovery a short time ago, and there is no doubt, from what I learn, it will soon occupy a prominent position amongst dividend mines. The latter, by its monthly returns of ore, speaks for itself, and success in it no doubt is secured.

AN OLD FLINTSHIRE MINER.

NEW MINES, ESPECIALLY LEAD.

SIR,—Apart from the growing interest attached to the Welsh districts, which are now causing such marked attention in the development of lead ore, there are also lead ore districts in the West of England that are commanding attention. We may instance the neighbourhood of Bridford, South Devon, the site of the rising Frank Mills Lead Mines, which have done so well of late—in fact, this Teign Valley country has so far advanced in public estimation as to cause a most searching inspection of the whole neighbourhood by efficient mining engineers, the Frank Mills lodes forming the basis of their research. These lodes having been found to be continuous through the adjacent properties they have been opened upon by enterprising men, and as much as 2000*l.* has been spent in mining operations to prove them; the results have afforded much satisfaction to the proprietors. The lodes have been sufficiently proved for their purpose, and an almost unlimited supply of barytes has been discovered, which, being both easily and cheaply raised, will return on a limited scale of working sufficient capital to further develope the lead lodes—a paying pursuit.

These reports having prompted further and public enquiry, a party of gentlemen have determined upon working them. A company, styled the Teign Valley Lead and Barytes Mining Company (Limited), has been formed, and their prospectus will be found in this week's *Mining Journal*. In support of this spirited scheme, it can be fairly stated that these proved lodes (in the Teign Valley) have been mainly instrumental in causing a branch railway to be made from the South Devon line, which is now in progress, and will shortly be completed. Hence the whole undertaking is worthy of public inspection and support, especially the mass of barytes that may at once be marketed to a profit through the means of the railway passing so near to the mine.

St. Stephen's-street, Bristol. R. G. S.

MARIQUITA MINING COMPANY (LIMITED).

SIR,—What I would say at a meeting of the proprietors of this company would be something to this effect:—

1. Let the directors ascertain from Mr. Brandon and the other creditors at what lowest terms possession of the property could be secured to the company.—2. This being satisfactory (not otherwise), let 50,000*l.* be raised on debentures, bearing 10 per cent. per annum, issued by the company to shareholders only, and that *pro rata*.—3. In the event of this interest at any time falling being paid as becoming due, the whole property of the company to lapse from that moment to the debenture-holders.—4. Let one necessary qualification for any superintendent, director, or official of the company be, from this present moment, the holder of some of these debentures, (say) 250, at least.—5. Let another condition for any such office aforesaid be that any salary, beyond that involved in actual maintenance and travelling, be contingent on actual profits.—6. At Santa Ana let all the physical force of the establishment be concentrated upon the working of the mine. Thus, the new shaft and skips would furnish ore for exportation.—7. This mineral, submitted to the action of a stream of falling water immediately near the mouth of the shaft, would develope at once, to a practiced eye, the comparative value of contents. Let it be reduced by means of "spalling-hammers" to 100*l.* per ton.—8. Pack in "serones," or, if preferred, in wooden boxes; convey to Honda, for export to England; 10*l.* will more than pay for transmission of each ton.—9. At Marmato continue things as they are, only retrench, retrench, retrench. Let all officials be holders of debentures, and be mainly dependent upon the monthly profit for actual cash payment of salaries.—10. Nor let the last-named condition seem to them severe; for unless some such plan secure (so to speak) success to the new effort no funds will be forthcoming.

As a practical man, I venture to suggest plans of this kind rather than that the valuable possession of the company should be lost entirely to the proprietors.

WILLIAM LEAY, M.A.,
Six years resident at Santa Ana and Marmato.

Downside Vicarge, Bath, March 9.

THE MAGNETIC IRON SANDS OF CANADA.

[*From the American Engineering and Mining Journal.*]

SIR,—So many enquiries have come to me of late about the magnetic iron sands of Canada, their extent, composition, and mode of working, that I am induced, in advance of a report about to be published by the Geological Survey, to send you a few notes, hoping that you will give them publicity through your valuable Journal.

The sands from the mines of the crystalline rocks in Canada, as in most other regions, hold considerable quantities of iron ore, which along the shores of lakes and of the sea is seen partially separated by a natural process of concentration through the action of the water. The ancient marine sands which are found in the lower St. Lawrence, from the present sea level to altitudes of several hundred feet, are often bounded and barred with layers discoloured by black iron-sand grains, and in some places the beds of several inches in thickness are almost free from the admixture of sand. More generally, however, to obtain it of such a degree of purity requires a process of artificial concentration by washing or otherwise. The black sand thus obtained is not homogeneous, but may be separated into a magnetic and a non-magnetic portion, the latter predominating in the washed sand. While the magnetic part is nearly pure magnetic iron ore, the other portion contains from 30 to 35 per cent. of titanic acid, and consists in great part of titanic iron (menaccanite), with some admixture of garnet.

Successful attempts have been made to work these iron-sands at Moisic, where they are treated in bloomery fires, and are reduced without difficulty, the daily yield of iron to each furnace being as great as in the similar furnaces of Northern New York, where non-titaniferous ores are used. The bar-iron thus produced is of excellent quality, and contains no titanium in its composition, while the fluid and readily crystallisable slags hold a great deal of titanic acid as silico-titanate. The layers of iron-sand at the Moisic are very rich, and the same is true of many other deposits in that vicinity, and at Mingan, Natashquan, and elsewhere; but in many localities there are great quantities to be obtained which yield by washing from 8 or 10 to 30 or 50 per cent. of heavy black sand. Attempts have recently been made to purify these by means of a magnetic separator, which leaves behind both the silicious and titanic portion. For the bloomery fire such a degree of purification is not required, but for some of the newly-proposed processes of direct conversion, or for the manufacture of malleable iron from pig metal by the Ellershausen process, and generally for ore intended for separation, it is deemed desirable to get as high a percentage of iron as possible, or, in other words, to obtain pure magnetic iron ore. This, in the case of these titaniferous iron-sands, can only be attained by the use of magnets. Dr. Larne, professor of chemistry at the Laval University, Quebec, has contrived for this purpose a simple and ingenious machine, which appears to be entirely novel in its arrangement, and is very efficient and rapid in its action. One of these I have seen in operation at Quebec, and of another put in operation at Clifton, New York, I have been furnished with an account by Dr. Larne. This machine, which is fitted with batteries of permanent magnets, occupies a space about 6 feet by 5 feet, and is 4 feet high. From 3 tons of sand, holding one-third of magnetic ore, it will separate in an hour 1 ton containing over 99 per cent. of magnetic iron—or 24 tons in 24 hours. The wear and tear and the motive power required are very small, and two men can, it is said, tend ten machines.

It was estimated at Clifton that the cost of purifying such iron-sand would not exceed 3 cents per ton. Of course, if applied to massive ores the cost of crushing and sifting would be added. By proper adjustment this machine may be adapted to the preparation of lean massive ores for the bloomery fire, or for other direct methods of conversion into iron or steel. Meanwhile the deposits of iron-sand, which may be utilised by means of this machine, on the north shore of the St. Lawrence, from the Saguenay to Newfoundland, are practically inexhaustible. Dr. Larne informs us that, inasmuch as a rich sand may be passed through the machine as rapidly as a poor one, the yield of the machine varies directly with the proportion of magnetite present; so that a sand containing (say) 9 per cent. would yield 6 tons in 24 hours. Even the poorer sands may thus be used with advantage.

It is not, however, to the lower St. Lawrence that these sands are confined; they are met with in considerable quantities at Batiscan, between Quebec and Montreal, and a large accumulation of black iron-sand at the mouth of Lake Huron attracted attention some years since. Similar deposits have been observed on both shores of Lake Erie, and I was informed more than 20 years ago that attempts had been made to collect the iron-sand along the shore, and use it, together with bog ore, in a blast-furnace on the Canadian shore. The iron-sands of Taranaki, in New Zealand, are well known; and similar sands, according to Bruno Kerl, are worked in open hearths near Naples. Black magnetic iron-sands are found distributed in greater or less abundance in numerous localitias along the seaboard of Connecticut and Rhode Island, and it is said upon some of the adjacent islands. The utilisation of these abundant and wide-spread deposits of an ore which is free from phosphorus and sulphur, and may be obtained in a great degree of purity by the magnet, is a problem well worthy the attention of metallurgists, and is already attracting considerable attention.—*Montreal, Jan.* 20. T. STERRY HUNT.

[For remainder of Original Correspondence, see this day's Journal.]

GOVERNMENT MINE INSPECTION.

The fact that the main principles of the Mines Regulation Bill have been generally approved by both coalowners and colliers, and that the metalliferous miners do not object to its extension so at to make it apply to all mines without exception, may be accepted as almost conclusive evidence that the measure has been framed so as to secure justice to all parties concerned; and as the representatives of each particular interest have been exerting themselves to obtain modifications which will render it still more nearly perfect, it may be hoped that the result of the House of Commons Committee, fixed for Friday next, will be to give Great Britain a mining law equal, if not superior, to any in existence. The modifications which appear to be desirable can be best pointed out by taking each clause separately; for in almost every clause some verbal amendment will probably be necessary.

1.—The short title "The Mines Regulation Act, 1870," can remain as at present.

2.—If the Act be made to apply to *all* mines, it will be unnecessary to exempt Ireland from its operation in respect of those of coal and ironstone.

3.—As to the commencement of the Act, the coal owners suggest that Jan. 1, 1871, should be fixed; and to this there would seem to be no objection.

4.—This clause being the interpretation clause, does not require amendment.

The sections from 5 to 10, inclusive, refer to "mines in general" at present; so that if the whole Act be made so to apply, this title would have to be removed. It might be replaced by the sub-title—"Employment of Woman and Children," &c.

5.—As the clause stands at present, it provides that no child under 12 years and no woman above that age shall be employed underground. The coalmasters desire to add a proviso, which is equivalent to the re-introduction of the second clause of the Act of 1860. They would insert—

"Provided that a boy above the age of ten years and under the age of twelve years may be employed in a mine or colliery upon either of the following conditions; that is to say—

That before any such boy is so employed the owner of the mine shall obtain a certificate under the hand of a competent schoolmaster that such boy is able to read and write

Or that, in the second and every subsequent lunar month during which such boy is employed in such mine or colliery the owner shall obtain a certificate under the hand of a competent schoolmaster that such boy has attended school for not less than three hours a day for two days in each week during the lunar month immediately preceding, exclusive of any attendance on Sundays.

And the owner shall file and preserve such certificates as aforesaid so long as such boy shall continue in ehe employment, and during six months after the termination of such employment, and shall produce during such time such certificates to an inspector when required to do so by him."

6.—No lad between 12 and 16 years is to be employed underground "except during a period not exceeding twelve consecutive hours, with intervals amounting to not less than 1½ hour for meals during each such period of employment, and with an interval of not less than 10 hours between each such period of employment." The coalmasters propose to say "meals and rest," which is not objectianable; and to make the latter part of the clause read "and with an interval, except between Friday and Saturday, of not less than 10 hours and between Friday and Saturday of not less than eight hours." This the colliers naturally consider neutralising the clause altogether, and would strongly oppose it. Even as it stands, the colliers complain that the hours of labour for the young may be 14 hours out of 24, although this would not be likely to occur in practice. The clause as it stands at present is, probably, as equitable as could be desired.

7.—The clause extends the provisions of the "Workshops Regulation Act, 1867," to all women, young persons, and children employed above ground in connection with any mine. The coalmasters propose to strike out the clause altogether, and this is, perhaps, the best that could be done with it.

8.—This provides that a register of all lads under 16 years employed in the mine shall be kept by the owner or agent. The coalmasters wish to throw the responsibility upon the immediate employer of the lad; this would be decidedly objectionable; but the addition of the words "in such mine" at the end of the clause seems to be an improvement, if not absolutely necessary.

9.—This provides that machinery worked by steam-power shall not be placed in charge of a lad under 18; and that, if worked by animal or manual labour, it shall not be in charge of a lad under 15 years of age. Neither party objects to this clause,

10.—The coalmasters propose that the owner or agent of a mine shall be guilty of an offence against the Act only if he acts or *knowingly* permits any person to act in contravention of the Act. They also propose that the employer shall be exempt from penalty if the lad has been declared of sufficient age by *himself*, his parent or *natural* guardian.

11.—Upon this clause several important modifications are proposed. The coalmasters propose to make the second subsection read—

"All wages and money in respect of wages payable to persons employed in or about any [coal or ironstone] mine shall be paid fortnightly, and within eight days of the last day of the week in which such wages have been earned, and shall be paid only in money by the immediate employer of such persons or his agent, at an office which is appointed by him for the purpose, and is situate in conformity with the foregoing provisions of this section, and is notified in manner prescribed by the special rules of the mine."

The coalmasters also propos to insert an additional clause after this, in order to provide for stoppages made for the men's own advantage. The proposed clause is—

"Provided that stoppages or deductions from wages may be made in respect of rent, medicine, or medical atttendance, and fuel and such materials (except as after mentioued), tools and implements as may be used by the person employed, and in respect of money advanced to the person employed for his relief in sickness, or for the education of any of his children, provided that such stoppage or deductions shall not exceed the real and true value of such fuel, material, tools, and implements, and the actual cost of such medicine, medical attendance, and education; and that the owner or agent do at the end of every twelve months post at the principal office of the mine a properly vouched balance-sheet of all outlay and of all the stoppages and deductions made at the mine in the year preceding in respect of medicine or medical attendance, and education."

These provisions seem so extremely fair, philanthropic, and straightforward, that it is difficult to see any possible objection to their enactment. The existence of such a clause would at least ensure to the family of the miner many comforts and conveniences of which the colliers' expenditure at the beer house now deprives them.

12.—This clause provides that persons employed in mines shall be paid by weight, measure, or gauge. The colliers propose that instead of this all minerals shall be tested by standard weight—that is, by the imperial pound as the standard unit. This we regard as a most desirable change; but as in some cases it might be an inducement to send up an unnecessary proportion of small (for round coal *measures* much more than the same weight of small), it should be provided that when the small exceeds per cent. the weight of the round remaining after passing over an 1-inch screen shall alone be paid for. The percentage would, of course, have to be a matter for arrangement at each pit, as it would depend upon the nature of the seam, and various other circumstances. In the latter part of the weighing clause, the coalmasters propose to omit the words "regard being had to the duties of the weigher towards the persons on whose behalf he is stationed." The removal of these words could only be justified on the supposition that they would under any circumstances be implied, and even this would be an inadequate excuse for removing them. The proposition of the colliers to insert that "the weigher (appointed by the men) shall have all needful facilities for the proper performance of his duty," could scarcely be adopted without laying the foundation for disagreeable disputes. The clause as it stands secures the check weigher ample power.

13.—The placing of the weights used at collieries within the reach of the inspector of weights, and measures for the district is agreed to by all parties.

Of course, the heading "Coal and Ironstone Mines" is unnecessary.

14.—This clause relates to the prohibition of single shafts, and the amendment proposed by the coalmasters is decidedly objectionable. The clause as it stands says "by which shafts or outlets distinct means of ingress and egress are available." The coalmasters propose to alter it to "ingress and egress *shall be available within a reasonable time.*" The removal of the word "temporary" in the second paragraph of the clause, which is also proposed by the coalmasters, appears to be rather an improvement than otherwise.

15.—This is a saving clause to meet existing exemptions.

16.—The object of this clause is to give power to enforce by injunction and penalty compliance with the Act, so far as it relates to shafts and outlets. The coalmasters merely desire that the clause shall only take effect "after due notice to the parties," which seems perfectly just. The colliers pass by the clause. But it seems that the value of the Act would be much enhanced by substituting the corresponding clause (with some verbal modifications) in Lord KINNAIRD'S Bill. The clause which it would appear desirable to substitute would be somewhat as follows:—

"Any of Her MAJESTY'S superior courts of law or equity, if satisfied that due notice has been given to the parties, may upon the application of the Attorney-General, if in England or Wales, and upon the application of the Lord-Advocate, if in Scotland, acting respectively on behalf of the Secretary of State, prohibit by injunction or interdict, as the case may be, the working of any mine at which it is alleged and proved to the satisfaction of the Court that, notwithstanding the prohibitions and penalties or other remedies provided to the contrary, the mine cannot be worked with due regard to the health and safety of the miners employed in working the same, or that the provisions of this Act are so habitually violated at such mine as to defeat the objects and purposes of this Act, and the Court may award such costs in the proceedings, and may also impose such restrictions and penalties, under recognizance, or bond, or otherwise, as the Court thinks just; but this section shall be without prejudice to any other remedy permitted by law for enforcing the provisions of this Act."

17.—This clause provides that any person may make a second shaft or outlet, notwithstanding any agreement to the contrary, and that he shall not be liable to penalty for so doing. No one objects to it.

18.—This is the general rules clause which is altered to be applicable to all mines, and to include some of the chief amendments which have been proposed:—

1.—An amount of ventilation shall be constantly produced in every mine, except under circumstances that could not reasonably have been anticipated, adequate to dilute and render harmless noxious gases to such an extent that the working places of the pits, levels, and workings of every such mine, and the travelling roads to and from such working places, shall be in a fit state for working and passing therein. Provided that no owner, agent, or other person shall be held to have acted in contravention of this regulation, if it is shown that all reasonable precautions have been taken by the owner, agent, or person who is so charged.

2.—All entrances to or outlets from any underground part of a mine, and every winze, sump, or shoot in a mine not in actual course of working, extension, or use, shall at all times, while not in course of working, extension, or use be properly and securely built up (or fenced to prevent persons inadvertently entering the same), unless the contrary is required for aiding ventilation, or for access or for other purposes connected with the working of the mine; and in case the same or any of them are required for aiding ventilation, or for any such access, or other purposes, then the same, or such of them as may be so required, shall be fenced.

3.—Every working approaching any place where there is likely to be an accumulation of gas, no lamp or light shall be used other than a safety-lamp.

4.—Whenever safety-lamps are required by these regulations or by the special rules (in this Act mentioned) to be used, they shall not be used until they have been first examined and securely locked by a competent person, or persons, duly authorised for this purpose.

5.—In any mine, or part of a mine, in which safety-lamps are required by these regulations or the special rules to be used, no person shall use powder or other explosive or inflammable substance for the purpose of blasting, or of getting coal or ironstone, except to the extent and in the manner authorised by the special rules.

6.—Where a place is likely to contain a dangerous accumulation of water, the working approaching such a place shall not exceed 6 feet in width, and there shall be constantly kept a sufficient distance, not being less than 5 yards in advance, at least one bore-hole near the centre of the working, and sufficient flank bore-holes on each side.

7.—Every underground plane on which persons travel, which is self-acting or worked by an engine, windlass, or gin, shall be provided (if exceeding 50 yards in length) with some proper means of signalling between the stopping places and the ends of the plane, and shall be provided in every case at one side or the other of such plane, at intervals of not more than 20 yards, either with sufficient man-holes (or places of refuge), or with a space (for a place of refuge) of sufficient length, and of at least 3 ft. in width, between the wagons running on the tramroad in the plane, and one side or the other of the plane, which man-holes or space shall be constantly kept clear.

8.—Every level or inclined plane where the load is drawn by a horse or other animal shall be provided, at one side or other of the plane, at intervals of not more than *fifty* yards, either with sufficient man-holes or with a space of sufficient length and of at least *three* feet in width between the wagons running on the tramroad in the plane and one side or the other of such plane, which man-holes or space shall be constantly kept clear.

9.—Every shaft or pit which for the time being is out of use, or used only as an air-pit, shall be securely fenced.

10.—Every working and pumping pit or shaft shall be properly fenced, but this shall not be taken to forbid the temporary removal of the fence for the purpose of repairs or other operations, if proper precautions are used.

11.—Every working and pumping pit or shaft where the natural strata are not safe shall be securely cased or lined, or otherwise made secure.

12.—Every working pit or shaft shall be provided with some proper means of communicating distinct and definite signals from the bottom of the shaft to the surface, and from the surface to the bottom of the shaft.

13.—Every shaft used as a ladder-way and hauling-shaft at the same time shall be securely "divided" off.

14.—Every part of a mine used or which may be used as a ladder-way in passing from one part of the mine to another part thereof shall be fenced.

15.—A sufficient cover overhead shall be used when lowering or raising persons in every working pit or shaft, except where it is worked by a windlass or gin, or where the person is employed about the pump or work of repair in the shaft, or where a written exemption is given by the Inspector of the district.

16.—A single-linked chain shall not be used for lowering or raising persons in any working pit or shaft, except for the short coupling-chain attached to the cage or load.

17.—There shall be attached to the drum of every machine used for lowering or raising persons flanges or horns, projecting sufficiently to prevent the rope from slipping off the drum.

18.—There shall be attached to every machine worked by steam, water, or mechanical power, and used for lowering or raising persons, an adequate break, and also a proper indicator (in addition to any mark on the rope), which shows to the person who works the machine the position of the cage or load in the pit or shaft.

19.—Every part of the machinery used in or about the mine near to which persons are liable to be employed, or to pass in the course of their employment, in or about the mine, and which may be dangerous to such persons, shall be securely fenced so far as practicable.

20.—Every steam boiler shall be provided with a proper steam-gauge and water-gauge, to show respectively the exact pressure of steam and the exact height of water in the boiler, and with a proper safety-valve.

21.—Iron tamping rods and prickers shall not be used in preparing holes for blasting in any mine.

22.—Where a mine is known to give off dangerous gases, a barometer and thermometer shall be placed above or below ground, under the charge of the viewers.

In the proviso to the second general rule the coalmasters propose to alter "if it is shown," &c., to "unless it shall be shown that all reasonable precautions have not been taken." This would be most objectionable, for it would practically relieve the owner of responsibility, and throw the burden of proof of neglect upon some person unknown. The coalmasters propose to strike out the fifth general rule altogether, but it appears useful, and should, we think, be permitted to remain.

19.—This clause makes rules for the men, regarding as an offence against the Act—

1.—Being in any place where a safety-lamp is required by this Act or by the special rules to be used, unlocks or wilfully damages any safety-lamp, or uses any safety-lamp which he knows to be defective.

2.—Wilfully damages or without proper authority removes any fence, fencing, or casing provided in compliance with this Act.

3.—Wilfully damages, or without proper authority removes or renders useless any means of signalling, signal cover, chain, flange, horn, break, indicator, steam-gauge, water-gauge, safety-valve, barometer or thermometer, or other thing in any coal and ironstone mine provided in pursuance of this Act.

4.—Places anything in any place of refuge so as to prevent proper access thereto.

5.—Fails to observe such directions with respect to working as may be given to him with a view to comply with the regulations respecting working contained in this Act or the special rules.

The only alteration suggested is one by the coalmasters, to add the words "or negligently" after "wilfully" in the second and third rules, and this we do not think can be reasonably objected to.

20 to 30 inclusive relate to the establishment of special rules; provide for the continuance of existing special rules, establishment of new special rules, objection of Secretary of State, amendment of special rules, neglect of owner to make special rules, for the publication of rules, and for offences against rules; and also require notice to be given of opening and abandonment of mine, order the fencing of abandoned mine, and the giving of notice of accidents in mines to the Inspector of the district. No alterations are suggested.

31.—This clause contains the provisions as to arbitrations. The only alteration suggested is by the coalmasters, who propose that "no person shall act as arbitrator or umpire under this Act who is employed in, or in the management of, or is interrsted in the mine to which the arbitration relates, *or who is not a mining engineer*." The alteration appears desirable rather than otherwise, for it cannot be expected that anyone not thoroughly acquainted with mining could satisfactorily perform the duties of the office.

32 to 38 inclusive relate to the appointment of Inspectors, disqualify certain persons from acting as Inspectors, define the power of Inspectors, explain how causes of danger not provided for by the rules are to be dealt with, provide that the owner shall keep up plan of working to within six months of date, order maps of abandoned mines to be deposited with the Secretary of State, and require every Inspector to make an annual report. The only alteration suggested is by the coalmasters, who propose to strike out the clause ordering the keeping of plans of young mines to within six months of date. As the keeping of such plans would be quite as advantageous to the coalmasters as they would be to anyone else, the alteration appears to be undesirable.

39.—This clause relates to the adjournment of coroners' inquests on deaths from accidents in mines. No alteration is proposed.

40.—This clause describes the penalties for offences against the Act. It was framed to meet the arrangement come to at Lord ELCHO'S, and with regard to which it was held that "the principle of equality, in itself just, to be justly applied as between employers and employed." It is not proposed to alter the principle, but the coalmasters suggest certain verbal modifications. In the subjoined the proposed omissions are enclosed in brackets, and the proposed insertions in parenthesis:—

40.—Every person employed in or about a mine, other than an owner or agent, who is guilty of any act or omission which in the case of an owner or agent would be an offence against this Act, shall be deemed guilty of an offence against this Act.

Every owner and every agent, and every person employed in or about a mine, who is guilty of an offence against this Act, shall be liable to a penalty not exceeding, if he is an owner or agent 20*l*., and if he is not an owner or agent 2*l*., for each offence; and if the inspector has given written notice of any such offence, to a further penalty not exceeding 1*l*. for every day after such notice that such offence continues to be committed (not exceeding 21 days).

Every owner and agent, and every person employed in the mine, who (by his personal act) is guilty of any offence against the Act which, in the opinion of the Court that tries the case, is one which tended to endanger the safety of the persons employed in or about the mine, or to cause injury to any such person, or to cause a dangerous accident, and was committed by the wilful [act or] (personal) default or [wilful] negligence of the person accused, shall be liable [instead of a penalty] (if he is an owner or agent, to a penalty not exceeding 100*l*., and if he is not an owner or agent to a penalty not exceeding 10*l*., and in the event of non-payment) to imprisonment, with or without hard labour, for a period not exceeding three months.

Every person who is guilty of any contravention of or non-compliance with any provision of this Act, which contravention or non-compliance is not expressly declared to be an offence, shall be liable to a penalty not exceeding 20*l*. for each offence.

41.—This clause provides for summary proceedings for offences, &c., under the Act. The coalmasters suggest that they *shall* be prosecuted within one month, instead of *may* be prosecuted within three months. This alteration will, probably, not be objected to.

42.—No mine owner or agent, or close relation of mine owner or agent, is to act as judge in any case concerning the mine. This is but reasonable.

43.—This clause states how the penalties are to be applied. It is not objected to by either party.

44 to 46, inclusive, provide that a certified copy of rules shall be evidence, that notices may be served by post, and that existing Inspectors shall continue to act as at present until instructed to the contrary.

The coalmasters propose to add two new clauses—

47.—No person who has been tried under this Act for any offence thereunder shall be liable to any indictment or other proceeding for the same offence, nor shall any person who has been tried on an indictment or other proceeding for any offence punishable under this Act be liable to be tried thereunder for the same offence."

48.—"No proceedings shall be instituted for one and the same offence against both owner and agent, unless for some act by them jointly committed or omitted, and no agent shall be held to have contravened this Act unless it be proved that the act commisted or omitted formed part of his own personal duty."

(49) 47.—Repeals the Acts 5 and 6 Vic., c. 99; the Mines Regulation Act, 1860; and the Double Shaft Act.

PROPOSED INSPECTION OF METALLIC MINES.

IMPORTANT MEETING AT REDRUTH.

A largely and influentially attended meeting of gentlemen interested in the mining enterprise of Cornwall was held on Monday, at Tabb's Hotel, Redruth, to consider the Mines Regulation and Inspection Bill, recently introduced into the House of Commons by the Home Secretery, Mr. Bruce; and the Metalliferous Mines Bill, brought forward by Lord Kinnaird. Mr. T. S. BOLITHO occupied the chair; and there were present amongst others Lord Falmouth, Mr. J. St. Aubyn, M.P., Mr. A. Pendarves Vivian, M.P., the Rev. J. Perry, the Rev. J. W. Hawksley, Capt. Bassett, Messrs. J. T. H. Peter, T. Cornish, H. Rogers, R. Boyns, Downing, W. M. Grylls, W. Shilson, P. P. Smith, Arthur Willyams, Reginald Rogers, J. G. Dymond, C. Childs, S. H. James, T. B. Laws, G. Williams, J. Williams, H. Grylls, W. Simmons, Rodda, T. Angove, R. Grylls, J. Newton, F. Hill, W. West, G. Clyma, R. H. Pike, W. Pike, Tregay, Hocking, H. Cox, W. C. Vivian, J. Haye, J. Willoughby, G. Cartwright, H. Harris, J. Thomas, S. Abbott, G. Cornish, J. Kendall, J. Evans, F. Barrett, C. Thomas, A. Lanyon, W. P. Cardozo, D. Bain, F. Penrose, R. Pryor, R. Quentrall, S. P. Michell, E. Dunsterville, W. Teague. Letters had been received expressing regret at being unable to attend from Sir John Trelawny, M.P., Mr. J. J. Rogers, Mr. Warington Smyth, and Mr. Magniac, M.P.

The CHAIRMAN referred to the fact that the Mines Assessment Committee were still in existence, and would take action whenever any Bill for mining assessment was brought forward. They adhered to the principle laid down at the county meeting at Truro, that the county would agree that dues or royalties should be rated, and not royalty only. By the Bill brought in in 1868 it was proposed that mines should be rated at the amount at which they would let from year to year; this the county opposed, and the Bill was withdrawn. They had now reason to hope that they would be able to satisfy the Government that royalty only should not be rated; but he could not speak definitely upon it. He would suggest that they should deal that day only with the Bills of Mr. Bruce and Lord Kinnaird, a summary of which had been prepared and circulated.

Mr. T. CORNISH, as secretary, then read the summary of Mr. Bruce's Bill, clause by clause, the meeting expressing its opinion upon them as he proceeded.

The clauses relating to the prohibition of the employment of women and children under 12 underground, and limiting the hours of labour of young persons between 12 and 16 employed underground, were unopposed. On the proposal to apply the provisions of the Workshops Act to the surface works at mines some discussion arose, the feeling being unanimously against it. It was stated by Captain Teague, Captain Williams, and Mr. R. Grylls that the operation of the clause would affect the parents much more than the adventurers. Two-thirds of the children were taken on as a matter of charity, and their labour could be done without.—The CHAIRMAN stated that the provisions of the Workshops Act were intended first to secure the health of children, and next their education. There was nothing unhealthy in the work on their mines, and he failed to see that the clause would have any practical bearing upon their education.—Mr. ST. AUBYN stated that Mr. Roden had put an amendment on the paper to omit the clause, and to substitute one which would prohibit the employment of children under 10 in collieries and ironstone mines, which would remove Cornish mines from its operation altogether.—Mr. PENDARVES VIVIAN remarked that the clause would be most strongly opposed by many coalowners.—Mr. H. ROGERS said his experience was that children were employed because they were wanted; and pointed out that the question must be looked at in connection with the Education Bill. He had taken the trouble to get up some statistics of the employment of children in the neighbourhood of Helston. In Breage there were 35 under 13, all on the stamping-floors; and in Wendron 63 boys and 11 girls. He found that amongst the children in the mines with which he was connected out of 74 there were only four boys and three girls who were unable to read; but in Breage out of 35, 16 could neither read nor write. He would propose that either the mines of Cornwall should be excepted altogether from the Bills, and a separate Act passed, or that, seeing that the children only worked nine hours, including meal time, period should not be at all abridged, but that they might go to school two hours in the evening.—Mr. BOYNS believed the labour of the children to be valuable, and that if they could not work the same hours as the others they would have to be got rid of.—Mr. ST. AUBYN suggested that the county members should not be tied down to support any particular amendment, but that they should be instructed to oppose the clause in its present shape. Then, in case their united efforts should fail in getting it expunged, they must make the best terms they could. Last year a resolution had been passed to substitute eight hours for six. Would that be accepted now?—Mr. Boyns, Mr. Williams, and Mr. R. Grylls held that this would not do—the children must work the same hours as the others, or they could not work at all. It was agreed that the clause was objectionable, and that if it could not be expunged it should be, if possible, modified in such a way as a committee appointed to advise the members should suggest.—The CHAIRMAN said he believed they would have to come to eight hours.

The next clause which gave rise to discussion, the intermediate ones being either agreed to or inapplicable, was the 29th. This provides for the fencing of abandoned coal and ironstone mines, and the CHAIRMAN said it had been suggested that it should be made applicable in Cornwall.—Capt. TEAGUE protested against all the burdens being thrown upon the adventurers; this was a matter which the lords should look to.—Mr. ST. AUBYN pointed out that there was an analogous clause in Lord Kinnaird's bill, which provided that shafts should be fenced or filled by the owner or proprietor.—Lord FALMOUTH thought there should be some means of defining when the fencing or filling of a shaft should be done by the adventurers, and when by the lord. It was often difficult to decide.—Capt. TEAGUE wished the lords were to be seen more frequently at the mines than they were: the adventurers would be glad to co-operate fairly with them.—Mr. CLYMA held that the fencing of these places should be made compulsory for the protection of life.—Mr. R. GRYLLS said that whilst a mine was in working the adventurers were responsible; but when it was abandoned, the owners.—Mr. H. ROGERS did not believe it would be fair to call upon the lord to fill up all the shafts that might be opened for temporary purposes.—The CHAIRMAN did not see that the clause could damage Cornwall, because it referred to the owner, and the adventurer, who was already bound by his lease to fence, could not be injured.—It was decided that the question should be left in the hands of the committee; Mr. CHILDS suggesting that the word owner should be better defined.

The next matters dealt with were the clauses relating to the appointment and powers of inspectors.—The CHAIRMAN did not see that the meeting could possibly object to them.—Mr. PENDARVES VIVIAN said collieries had been under inspection for 20 years. At first great objections were raised; but that feeling had quite died away, and inspectors were looked upon rather as friends than otherwise. This action had aided in reducing the loss of life more than 50 per cent.—In reply to an observation from Mr. H. Rogers, Mr. VIVIAN said the Government Inspectors of coal mines were efficient men, and thoroughly independent.—The Rev. J. PERRY considered the inspection clauses the most important part of the Bill. They had a few, but not many, preventable accidents; and they ought to do all they could to save life.—Mr. R. GRYLLS remarked that one advantage of the inspection of mines would be that they would not be subject to the misrepresentations of their neighbours.—Mr. CLYMA moved, and Mr. F. HILL seconded, a motion approving of the principle of inspection.—Mr. ROGERS, wishing to avoid inspection, though he agreed with it as regarded coal mines, moved that the members be instructed to get Cornwall excepted from the clauses if possible.—Mr. BOYNS also thought they should get rid of inspection if they could, though he would not work a mine which would not bear it. He seconded the amendment.—Capt. TEAGUE would be sorry that it should go forth that they were opposed to inspection; and believed they might get some useful hints as to machinery from the inspectors.—Mr. P. P. SMITH had no doubt they would all like to do their work without having any overseer; but as they could not hope to expunge the clauses they had better accept them ungrudgingly. There was a distinction made between the metal and the coal and ironstone mines; and so far as inspection referred to Cornwall it would be quite innocuous.—Capt. BASSETT really thought inspection should be supported by the mining interest. They need not be afraid of some very fine gentlemen coming down from London to inspect; the fact would be that they would have some practical men from among themselves.—The amendment was then withdrawn, and the motion carried, after Mr. ST. AUBYN had shown that under the Act the appointment would not be compulsory.

On the remaining clauses Mr. R. ROGERS expressed an opinion that it would be very advantageous to have plans deposited of all mines.

Mr. ST. AUBYN supposed that the members were to consider that there was no vital objection to Mr. Bruce's bill, with the exception of the seventh clause.

Lord Kinnaird's bill was then considered. With reference to the sixteen rules which his lordship would put it within the power of the Secretary of State to enforce in all mines there was no considerable discussion. The rule that no shaft should be used for the drawing up of stuff and as a way for miners unless divided was considered objectionable, and it was suggested instead that no shaft should be used for both purposes at the same time. The rule for the fencing of underground footways was objected to as vague and not needed; that for signalling in shafts was also declared impracticable; that for building up all abandoned workings was declared worthless and impracticable; that declaring that iron tamping rods and prickers should not be used for boring holes for blasting purposes was received with shouts of laughter; as was likewise that stating that every part of the mine and machinery should be inspected once in every 24 hours. The rules that fly-wheels should be fenced, that the best ventilation possible should be provided, and that boilers should be duly fitted with steam gauges, were approved.

The rest of the clauses were read through without other comment than an expression of disapproval.

Mr. SHILSON took it that the meeting generally approved of the Government Bill and disapproved of Lord Kinnaird's—(applause)—and would move that it should be left to the committee to decide what parts, if any of it, should be incorporated with Mr. Bruce's.

Mr. CHILDS seconded this. There were many good suggestions in Lords Kinnaird's Bill; but they could not be carried out as a whole. They wanted something to develope mining enterprise; but this measure might really be entitled an Act to prevent the further prosecution of mining in the county of Cornwall.

Mr. P. P. SMITH said Lord Kinnaird's Bill was merely a reproduction of the one which he brought in in 1866, and which was then rejected unanimously.

Mr. ST. AUBYN approved of the resolution, and thought it desirable that the opinion of the meeting should be put upon record for the guidance of the Government. Lord Kinnaird's Bill came on for its second reading on Friday, and he had had some correspondence with Lord Morley, who represented the Government on those matters in the House of Lords, upon the subject.

The Stannaries Committee were then appointed to deal with the Bills and advise the members thereon, with power to add to their number, and to appoint a sub-committee; and, on the suggestion of Mr. HENRY ROGERS, it was understood that they should also take into consideration the effect of the Education Bill upon the mining industry of the county. On the motion of Lord FALMOUTH, the thanks of the meeting were voted to the Chairman.

—*Western Morning News.*

MINE INSPECTION IN AMERICA.

Mr. John Eltringham, the Mine Inspector appointed by Governor Geary, under the Act for the Safety of the Lives of the Miners, passed by the Legislature last April, entered on his duties on May 1, and has sent his report to the Governor for the period extending from that time up to January, 1870. It is a very voluminous report, making a volume of manuscript several inches in thickness, and containing a mass of information in regard to the mines of great importance, which we supposed it impossible to collect in so short a period of time. All the work was accomplished by Mr. Eltringham and his clerk, Mr. P. W. McAndrew.

The report, we presume, will not be published by the Legislature, simply because a large portion of it is composed of details of the situation of the different collieries in the county, which is not of great public interest, but which is of importance towards securing a proper ventilation of the different collieries. We learn from Mr. Eltringham that he found the collieries in a much better condition in this county than he supposed they would be. In a number of cases he directed alterations to be made, to give greater security to the lives of the miners, and provide for better ventilation. Some owners of collieries have complied with the suggestions of the Inspector, others neglected to do so, and have been reported to the Governor. If the alterations should not be made soon they may be ordered to close their works until the necessary improvements are made.

We have been permitted to examine some portions of the report, which are of public interest, and have gleaned the following statistics from the same:—

Whole number of collieries examined in Schuylkill county since May 1 138

This embraces all the collieries in this county mining and shipping coal to market. There are about 25 small collieries mining coal for the supply of the different towns in the coal regions not embraced in the report.

The number of drifts (horizontal) are	134
Number of slopes (10°-50°)	115
Number of shafts (perpendicular)	13

The deepest slope below the water-level is 1500 ft.; the Duncan Colliery, abandoned at the close of the year, with 8 ft. of the finest red ash coal produced in the region at the bottom of the slope. The next deepest is 1443 ft., another is 990 ft., and another 972 ft.

The deepest shafts are the Wadesville, 665 ft.; the St. Clair shaft, 620; others are 600, 364, 350, four of 300 each, 257, 250, 140, and 124.

In the ventilation of the collieries below water-level there are used:

Furnaces	39
Fans	60=99

In 10 collieries where the furnaces are used there is but one outlet for the men, but these collieries are not extensive, and some are new ones, which do not require much ventilation.

The number of men and boys employed at the 138 collieries were.	17,204
Number of mules used	1,625
Number of drift-cars	6,266
Number of steam-engines at mines	460
Aggregate horse-power	25,221

The number of persons killed in the 138 collieries in Schuylkill county from May 1, 1869, to Jan. 1, 1870, was 55 in 38 collieries. The number of injured were 90 in 41 collieries. Taking the quantity of coal mined after May 1, it would give one person killed in Schuylkill county for every 65,000 tons mined, and one person injured for about every 34,000 tons mined. At least two-thirds of the deaths are caused by falls of coal and slate, and a large proportion of those injured arises from the same causes. But few deaths, comparatively speaking, have occurred in Schuylkill county from explosions, which are caused by bad ventilation in mines.

The above is an abstract of Mr. Eltringham's report, given in the Pottsville *Miners' Journal*, of the 29th ult. The Journal goes on to give its own statistics of the same subject, thus:—"We sent circulars to all the operators in the Anthracite Coal Regions, making enquiry as to the number of deaths in their collieries and the number injured. We received replies from only 49 collieries in Schuylkill county, which gives 11 killed, 67 wounded, and 11 deaths from wounds. From the Shamokin region we have 12 returns, giving 5 killed, 13 wounded, of which 4 died. From the Lehigh region we have returns from 16 collieries, including the Lehigh Coal and Navigation Company. These give 4 killed and 10 wounded, of which 2 died. The Lehigh Coal and Navigation Company mined abou

450,000 tons from their eight collieries, and only 2 men were killed, and 2 injured slightly. From the Wyoming basin we have returns from 24 collieries, including the Delaware and Hudson Coal Company. These give but 2 killed and 33 injured, of which 11 died. We hope that those who have not yet furnished us with replies to these questions will do so as soon as possible, as we are anxious to have these statistics complete. We have incurred considerable expense already in their collection, and as they are for the information of all parties, a little more promptness on their part would greatly contribute to this end."

There is probably no coal region in the country so free from mining casualties as the Broad Top Coal Region. They have 22 collieries in all, 20 above water level and 2 below. They produced and sent to market, in 1869, 360,779 tons of coal, and only one person was killed in 1869 by being run over by a car of coal. Only 4 persons were slightly injured, and none of the 4 died from the injuries received. These collieries, we believe, are all worked under the superintendence of Mr. John Fulton, mining engineer.

In England, Scotland, and Wales, in 1867, there was one person killed for every 103,000 tons of coal mined. This is a much less number than occurred a few years ago in proportion to the production. The number, however, varies largely in different districts. In the district of West Lancashire and North Wales there was in 1867 one person killed to every 32,000 tons of coal mined. In England and Wales the average was about one to 96,500 tons mined, and in Scotland one to 174,000 tons mined. But in Scotland it is stated that they have about one person employed to every 15 persons working in the mines to watch the men and check the casualties.

All these statistics have an important bearing on the passage of a Ventilation Bill at Harrisburg. All the cumbrous Bills presented are nuisances. With three or four additional sections added to the Schuylkill County Bill, which we can point out, and then extend it to all the counties, it will prove to be better for the purpose than any of the others presented. The rules and regulations suggested at the different collieries by the Mine Inspector to suit the working of each colliery, is of more importance than all the sections that can be piled up in any Bill.

United States Railroad and Mining Register, Feb. 26.

THE COAL FIELDS OF THE NORTH PACIFIC.

The coal supply, no matter whence that supply is derived, is a subject in which everyone is interested, and accounts of new fields, or those with which we are but imperfectly acquainted, are particularly acceptable. For this reason the paper "On the Geographical Distribution and Physical Characteristics of the Coal Fields of the North Pacific Coast," read before the Edinburgh Geological Society, fairly claims favourable mention. The position of the author, Mr. ROBERT BROWN, F.R.G.S., as commander and Government agent of the first Vancouver exploring expedition, is a sufficient guarantee for the value of his opinion. He explains that extending from California to the borders of Alaska are three coal fields, belonging respectively to the Tertiary, Secondary, and Palæozoic ages, the latter being situated, as far as yet known, only in the Queen Charlotte Islands, off the northern coast of British Columbia, the exact age being as yet undetermined, though the coal is anthracite, and is, in all probability, Palæozoic. The other two coal fields are situated, as regards each other, from south to north, in the order of their age. The Tertiary extends from California northward, and through Oregon and Washington territory, impinging the southern end of Vancouver Island and British Columbia, and extending, with some interruptions, right across the Rocky Mountains, the Miocene coals of Missouri being apparently only a continuation of these same beds. The secondary beds, on the other hand, on the North Pacific coast, are confined to the Island of Vancouver, though, in all probability they are also a continuation of the cretaceous strata of Missouri.

With regard to the Tertiary coals of the North Pacific, Mr. Brown states that the lignitic beds are associated with shales and sandstones alternately, and the contained fossils show it to be of Miocene age throughout. The coal from it is of a very uniform character, burning freely, but leaving behind much slag and and ash; and in many cases, though giving out a strong heat, unsuitable for domestic purposes, on account of its sulphurous character. It has, however, been wrought at various places throughout its extent, and is at present being mined for commercial purposes at several localities—Monte Diabolo, California; Coose Bay, Oregon; Clallam Bay, opposite Vancouver Island; Bellingham Bay, and elsewhere. Regarding the quality of the coal it is difficult to form an estimate, from the often very partial reports of interested parties. It is, however, said that the clean picked coal gives very little ash, burns with a clear bright flame, and gives out considerable heat. Some of the large lumps contain veins of sandstone varying from ¼ to 1½ inch, and to this possibly may be attributed the great amount of "clinker" which it forms on the furnace bars. It is only just to say that all hitherto tried for steaming purposes has been merely surface coal, and, therefore, of inferior quality. The coal itself is hard, giving a brown lignite-like appearance on being scratched, shining equal to the appearance of anthracite, and breaking in small cubical fragments.

The valley between Olympia and the Columbia river, generally known as the Cowlitz Portage, appears to be a coal basin to some extent. Coal has been found not far from the celebrated Mound Prairie, about half-way over, and on the Monticello and Columbia rivers, but in such small quantities as hitherto to have rendered it unworthy of being wrought. If coal could be found in proximity to the splendid but undeveloped iron mines of the Columbia, the result would be of great commercial importance. Near the Squak prairie, 25 miles from the village of Seattle, coal is seen to crop out on the side of the mountain in seams of 2 or 3 ft. in thickness, but as its position would render its transportation expensive it creates but little interest. On the Stoluchwamish river, north-east of Seattle, a thin seam of coal has been found, but is not wrought. It is only when we arrive at Bellingham Bay, situated a few miles south of the British boundary line (latitude 49° north) that we find the coal of sufficient thickness and proximity to the sea to render it of sufficient importance to be mined. Here a company have been at work for a number of years, and export a considerable amount of coal to the San Francisco market. It is of the same quality as the other tertiary coals of the coast, and is generally mixed with a better class of coals before being used. The mines are very full of fire-damp, while the various mines of cretaceous age are entirely free from this.

The whole coast of Vancouver Island, on the east coast, north of Chemainos, and round to Koskeemo Sound, on the westward, and for some distance into the interior, is bounded by a belt of carboniferous strata, composed of sandstones, shales, and coarse gravel-stone conglomerates, interstratified with which are beds of coal of much superior character to any hitherto described. These beds, from the fossils they contain, appear to be cretaceous. Everywhere the strata named form a characteristic accompaniment of the coal, especially the coarse conglomerate just named; and nearly everywhere it is underlaid by one or more seams of coal. Hitherto we have only found it cropping out at some points of the circuit named, though it may reasonably be supposed yet to be found on the opposite shores of British Columbia. The wall of the deep fjords indenting this part of the coast everywhere are, however, in most cases composed of trap and other igneous rocks, and whatever sedimentary rocks may at one time have reposed on their flanks have now been washed off by the action of denudation.

The Nanaimo coal is bright, tolerably hard, and not unlike some of the best qualities of English or Welsh coal in appearance. It burns freely, with a good heat, but produces a great amount of ash. It is universally used by all Her Majesty's ships on the coast, and by all of the colonial and other steamers plying on the coast. It is highly valued as fuel for domestic purposes, both in Victoria, San Francisco, and other towns. Gas is manufactured from it at Victoria of good illuminating quality. No fire-damp has hitherto been found in the mine. The coal is easily wrought, a miner being able, under favourable circumstances, to take out about 2½ tons in his working time, which, at the rate of 5s. per ton for his clean dressed coal, will net him about 11s. per diem. Most of the miners are from Scotland or Lancashire, and generally employ an Indian to clean their coal for them. They rarely work a full day, preferring to earn a constant moderate wage rather than run the chance of getting the price lowered by their producing the coal in greater quantities.

North of Vancouver Island, at a distance of from 20 to 40 miles from land, lie the Queen Charlotte Islands, consisting of a group of three main islands, with a number of lesser islets lying off the shore. These islands are, in general, densely covered with forest, and permeated by inlest of the sea; but their interior is entirely unexplored, They are, however, rich in copper and other minerals; and gold quartz, of a surprisingly rich description, was discovered in one spot here about 15 years ago. A hot spring is found at the southern end of the most southerly island; but there is no volcano here, as Mr. Mallet erroneously places on his map of earthquake phenomena and volcanoes. The island, though so near the mainland, differs remarkably in having no deer, wolves, or racoons—animals extremely abundant on the opposite shores of British Columbia. The coasts are inhabitated by several tribes of a very fine-looking, stalwart, and warlike race, generally known under the name of Hydahs. There are no white settlements on these islands, but they are occasionally visited by well-armed traders, for the natives bear the reputation of being anything but a remarkably docile race, a reputation earned by many lawless and cruel acts.

Of late years coal has been discovered on these islands of a very superior quality. Accordingly, in the spring of 1866 I took advantage of a party of miners going up to "prospect" this coal to pay a visit to the islands. I saw no appearance of coal—or, indeed, of any sedimentary rock—along the whole coast of British Columbia until we arrived at these islands. Here the coal crops out in various places on the islands, but its chief development is at Skidegate Bay, where I passed some weeks. The whole of the beds seem to have been thrown out of position by erupted masses of felspathic trap, on the flanks of which the beds reposed, and by which the strata (sandstone, &c.) have been much metamorphosed, and the coal altered. Two rival parties of miners were there prospecting, and one of them had driven an adit into the hill side some 200 or 300 ft. above the sea level. Here they had gone through a great bed of coarse conglomerate—a fine hard slate—when the coal was reached. This conglomerate was in every respect similar to that associated with the Nanaimo coal fields, but the slate was peculiar. It is a close-grained, lustreless material, breaking in cuboidal fragments, and easily wrought. The coal was apparently of the nature of a true anthracite, with a bright lustre, hard, and giving out an intense heat. Recent efforts have been more satisfactory than the earlier ones, but Mr. Brown thinks that the working of the coal will always he difficult, on account of the numerous faults, dykes, and other disturbances.

FOREIGN MINING AND METALLURGY.

It appears that the quantity of minerals exported from Belgium last year was 159,000 tons, as compared with 136,067 tons in 1868, and 152,227 tons in 1867. The imports of minerals into Belgium last year amounted to 550,000 tons, as compared with 306,000 tons in 1868, and 322,891 tons in 1867. The exports of rough pig from Belgium amounted last year to 19,082 tons, as compared with 16,525 tons in 1868, and 11,062 tons in 1867. The imports of rough pig into Belgium amounted last year to 63,215 tons, as compared with 42,549 tons in 1868, and 53,385 tons in 1867. The exports of rails from Belgium in the last three years attained the following importance:—

	1869.	1868.	1867.
Russia ..... Tons	67,419	45,340	67,095
Sweden and Norway	730	—	—
Denmark	475	—	—
Zollverein	9,953	7,299	35
Low Countries	2,667	3,619	3,607
England	2,316	91	205
France	2,098	471	596
Spain	36	130	103
Italy	14,119	3,630	9,033
Switzerland	29	1,143	—
Turkey	28,148	700	—
Egypt	—	—	—
United States	6,773	6,816	—
Cuba and Porto Rico	69	—	—
Rio de la Plata	220	—	—
Miscellaneous	1,020	1,311	20
Total	136,063	70,550	80,875

The exports of plates from Belgium in 1869 amounted to 20,839 tons, as compared with 14,412 tons in 1868, and 12,591 tons in 1867. The imports of rails into Belgium amounted last year to 1890 tons, against 58 tons in 1868, and 153 tons in 1867. The imports of plates into Belgium last year amounted to 73 tons, against 114 tons in 1868, and 95 tons in 1867. The quantity of coal imported into Belgium last year was 226,893 tons; in 1867 the corresponding total was 421,219 tons. The diminution in the imports indicated by these figures has occurred principally in English and German coal. The quantity of coke imported into Belgium has become very small. In 1867 it stood at the respectable total of 22,880 tons, and in 1869 it had declined to 8714 tons. The quantity of coal exported from Belgium last year was 3,674,300 tons, as compared with 3,754,645 tons in 1868, and 3,564,308 tons in 1867. The falling off occurred principally in the deliveries made to France. The exports of coke from Belgium last year showed a steady increase to the Zollverein and France; the aggregate coke exports for 1869 amounted to 652,831 tons, against 539,965 tons in 1868, and 516,898 tons in 1867. Upon the whole, the statistics enumerated seem to present the Belgian coal trade in a satisfactory light; 1870 has also commenced well.

The Cologne and Minden Railway Company has let contracts for 9000 tons of Bessemer cast-steel rails. The larger part of the rails are to be supplied by the celebrated house of Krupp.

After the animation which the French coal trade has displayed for the last few weeks a slackening in affairs was, perhaps, necessary to give a little respite to two coal-workers of the Nord, the Loire, and the Pas-de-Calais, in order to enable them to meet the orders addressed to them. The temperature having become milder the demand has naturally become less pressing, but for all that the extraction in the mines is not the less pushed forward with vigour, as many orders have fallen somewhat into arrear in their execution. The deliveries by railway have been very considerable during the last few days; the movement upon the various navigations has also been on a large scale. The price of coal continues to be maintained with firmness in the various basins; unless cold weather should return there is little prospect, however, of any advance being established in quotations. The Paris coal market has been animated, the trade having experienced some difficulty in keeping up supplies; with a little mild weather, however, stocks would soon begin to accumulate again.

The iron trade in the Haute-Marne district has not presented much change. A moderate demand has been experienced for iron and casting pig; refined pig has also given rise to some transactions, and the sale is noted of two lots of charcoal-made pig of good quality, at 4*l.* 16s. per ton. Another lot of mixed pig, half coke-made, has brought 4*l.* per ton at the producing works. Prices on the markets of the Moselle and the Meurthe have been pretty well maintained. Pig and iron are firm in the Moselle and the Meurthe at former rates, and orders, as compared with those received in the Haute-Marne, present a tolerably regular current. If the Meuse and the Champagne districts did not send so much iron into the Moselle a still greater animation would be observable in transactions in that department. However, this may be, the forge-masters of the Moselle may consider themselves fortunate in having passed through the dead season without slackening their production. The Tillots concession, near Hayange, has been granted to the Denain and Anzin Blast-Furnaces and Forges Company, which intends, it is said, to at once establish a blast-furnace in the locality. The Meurthe has contracted for the supply of pig for Creuzot; the terms are not stated. The blast-furnaces and foundries of the Loire do not want for orders, their first fusion pig and castings being in fair demand. Iron has been somewhat quieter in the Loire district; some important contracts for steel and steel work are stated to have been concluded for some of the railway companies. We can only repeat as regards the department of the Nord that work is abundant in all the various establishments, and that prices are maintained with firmness. At Paris the iron trade has been quiet, but a good season is anticipated, and although transactions are not on a very considerable scale at present, prices do not give way. The price of merchants' iron at Paris, month by month, last year was as follows:—January, 8*l.* 8s.; February, 8*l.* 12s.; March, 8*l.* 16s.; April, 9*l.*; May, 9*l.*; June, 8*l.* 12s.; July, 9*l.*; August, 9*l.*; September, 9*l.*; October, 9*l.*; November, 8*l.* 16s.; and December, 8*l.* 12s. per ton. The Northern of Spain has ordered 2850 tons of Vignoles rails at 8*l.* 12s. in warehouse at Bordeaux, or 8*l.* 7s. 6d. delivered at Nantes. The Paris, Lyons, and Mediterranean Railway Company has ordered 2750 tons of coal wagons; of these, 500 will be supplied by MM. de Dietrich and Co., MM. Dupont and Dreyfus furnishing the ironwork; 500 by the Graffenstaden Works, Creusot furnishing the iron work; 250 by the Bressuire Works, 350 by the company's own works, 400 by the Fourchambault Works, 250 by MM. Bonnefond and Co., and 250 by MM. Desouche, David, and Co., Creusot furnishing the ironwork. The Northern of France Railway Company ordered in October 500 coal wagons, but this total being deemed insufficient a further order for 400 more coal trucks has just been given out by the administration. The Orleans Railway Company has ordered 300 coal trucks, and the Southern of France Railway Company has let a contract for 200 similar vehicles. The Western of France Railway Company has let contracts for 81 carriages, 25 baggage vans, 716 covered trucks, and 484 open trucks. A company for carrying out a line from Bordeaux to the Sauve will let contracts for 1800 tons of rails in the course of the current year, and the first few months of 1871. M. Vorns, of Nantes, is about to let an order for 4300 tons of rails, to be delivered next month, for the construction of the Tréport Railway.

The French copper markets have been rather firmer. At Havre disposable has been quoted at 68*l.* 8s. per ton. At Marseilles, Spanish has displayed rather a better tendency, at 68*l.* 16s. per ton. Toka has remained at 70*l.*, and Chilian 72*l.* per ton; rolled red in sheets, 78*l.* per ton; ditto round, 82*l.* per ton. On the German markets the article has become the subject of greater attention, but there is no material change in prices. Tin has sustained upon the French markets the advance recently noted upon those centres. The spring sale of the Dutch Society of Commerce will take place on the 31st inst., and will comprise 76,800 ingots of Banca, and 1700 ingots of Billiton. The announcement of these statistics has given a fresh impetus to the upward movement at Rotterdam, the totals being considered rather meagre; disposable Banca has brought of late 71 fls., while for deliveries in April and May 70 fls. is paid. The quantity of Banca *en route* from Java at the close of February was estimated at 69,000 ingots, as compared with 20,200 ingots at the close of February, 1869. The quantity of Billiton *en route* from Java at the close of February was estimated at 19,650 ingots, as compared with 19,000 ingots at the close of February, 1869. At Amsterdam as much as 71¼ fls. has been paid for disposable Banca. There is no great change to report in the various lead markets. At Breslau some foreign orders have given rather more animation to zinc, but at Hamburg the article has remained without much demand. At Paris, Silesian delivered at Havre has made 20*l.* 12s. per ton.

FOREIGN MINES.

RHENISH CONSOLS.—G. Sweet, March 1: Bliebach: The lode in the end driving west on the north lode, in the 10 lachter level, is 2 ft. wide, and presenting a favourable appearance, with good spots of lead ore. Nos. 1 and 2 stopes, in the roof of the 10 lachter level, on the middle lode, will afford respectively 1½ and 1 ton of lead ore per lachter. A stope in the roof of this level, east of No. 3 winze, on the north lode, will afford 1 ton of lead ore per lachter. A stope west of this winze will afford 15 cwts. of lead ore per lachter. We have two tribute bargains in the roof of the adit level, on the north lode, at 1¼ thaler per centner for clean lead ores.—Christiania: The end driving west, on the south part of the lode, in the 30 lachter level, is poor, but letting out a great quantity of water. A stope in the roof of the 20 lachter level, 15 lachters west of cross-cut, will afford 2 tons of lead ore per lachter. A stope west of cross-cut will afford 1 ton of lead ore per lachter. A stope in the roof of the 10 lachter level, and 15 lachters west of cross-cut, will afford 10 cwts. of lead ore and and 1½ ton of blende per lachter. We have commenced opening a winze plat in the bottom of the 20 lachter level, 10 lachters west of cross-cut, preparatory to sinking on the course of the lode. At this point the lode will afford 2 tons of lead ore per lachter, and the 30 end is driving in this direction. The weather, which has been so severe during this last month, and prevented us from cleaning but little ore, is now very mild, and the frost and snow rapidly leaving. Dressing operations are being carried on with all vigour, and the ores will be made marketable as rapidly as possible.—Estimated returns for February Month: Lead ores, 44⁰ centners 1300 thalers; blende, 100 centners, 100 thrs.=1400 thalers. Total cost on mines, 1470 thalers: deficit, 70 thalers.—Madonna: The depth attained at the engine-shaft is 7·5 lachters. The ground in the bottom is sandstone, and between the layers we occasionally find lumps of lead ore. Estimated cost for February month, 250 thalers.

NEW WILDBERG.—J. Sanders, March 4: East Mine: The drivin east at the Erbstollen is still yielding small branches and stones of ore, worth about ⅛ ton per lachter.—Carter's Shaft: The forebreast of the driving at the 70 is not quite as good as last week, the present value being 1 ton per lachter. The stope in bottom is worth 1¼ ton per cubic lachter, and the stope above the level 1¾ ton per cubic lachter. The rise and the stope above the 60, towards Johanna's sink, remains as last week, worth 1 ton of ore per cubic lachter. The different stopes above the 50, on Dornergang Erzkammer, remain as for some time past, yielding on an average 1 ton per lachter. The pitch on Gotteshulfe is not quite as good as last reported, the present value being ¾ ton per lachter, but, as the ore in this place is generally found in bunches, we expect an improvement again shortly.—Beck's Workings: Nothing has been set in this part of the mine for the present month as yet, the men who worked here formerly having taken pitches in other parts of the mine.—Blumengang: The stopes in this part of the mine remain as last week; the stope above the 70 is worth 2 tons; the stope between the 60 and 70, 1½ ton; and the stope above the 60, 1¼ ton of ore per lachter.—West Blumengang: During the week we have been timbering and securing the ground in this place, and since the frost has broken up some of the timber in the drawing-shaft at Blumengang has given way, and we are obliged to take the men from this place to secure the shaft. We have not yet commenced the driving of the 60 west from Blumengang towards the West Blumengang sink, but we intend doing so as soon as we can clear away the stuff accumulated there while pumping the water out of the West Blumengang workings.

PONTGIBAUD.—W. H. Rickard, March 2: Roure: The 80 metre level, south of Richards's shaft, is in a large lode, composed of quartz, spotted with ore. The 60 south yields 1 ton of ore per fathom. The 60 cross-cut east is in hard, sparry ground; the progress is very slow. The 20, north of cross-cut, on Virginie's lode, yields ¾ ton of ore per fathom. The same level south yields ⅛ ton. We have holed the rise to the winze sunk from the stollen, thereby effecting a good ventilation, and enabling us to drive the adit level north and south on this lode, which will open up tribute ground pretty speedily. The stollen cross-cut, west from Paul's shaft, has intersected several small branches, containing a little ore. The adit cross-cut, towards No. 3 lode, is in stiff ground. Our stopes and tribute pitches yield about the same as last month.—La Grange: The 100 metre level, north of Nosky's shaft, yields ⅛ ton of ore per fathom. The 80 north is poor: we have suspended this end until we begin to stope in the 100, so as to take the stuff therefrom for filling them up. The winze below the 80 yields ½ ton of ore per fathom. The 60 north is spotted with lead ore and mundic. The adit south is in unkindly ground, as for a long time past; we purpose suspending it if nothing is shortly met with. Our tribute pitches in this mine have a little improved in the yield on the whole.—Mioche: The adit north is in soft, unproductive ground. The rise in the back of this level yields a little saving work. We have suspended the level south of cross-cut, to continue driving the cross-cut further east, in hopes of meeting with some veins lying in that direction.—Bouzarat: We have begun to cross-cut west of the trial level in search of La Brousse lode.—La Brousse: The sinking of Basset's shaft goes on slowly; the ground continues hard and wet. The 100 metre level, north of shaft, yields ½ ton of ore per fathom. The 100 south yields a little saving work. The same level, on the western part of the lode, yields stones of orey stuff. The 80 south is poor. The 60, in the same direction, is spotted with ore, but not enough to save. Our tribute pitches continue to yield fairly, but are a little diminished in value.—Pranal: The 70 metre level, south of cross-cut, yields stones of lead ore and blende. We have set a rise in the 70 north, to communicate with the winze below the 50, over this point. The 50 metre level, north of cross veln, yields stones of ore occasionally. The winze in the south level yields ½ ton per fathom. The 30 north is poor. The 30 south yields ⅗ ton per fathom. The winze behind this end yields ½ ton per fathom. Our tribute pitches yield about the same quantity as last month. Our samplings have amounted to 250 tons.

[For remainder of Foreign Mines see to day's Journal.]

THE CHANNEL PASSAGE.—The recent stormy weather in the Channel has again directed public attention to the various projects for improving the passage between this country and the Continent, and a paper has been read before the French Academy of Sciences upon the subject. In England, however, most attention has been attracted to the raft scheme of Mr. Fowler, and we notice that some of our contemporaries have fallen into the error of representing the rival project of a bridge for connecting the railway systems of the two countries as a bridge of 190 piers, and costing 30,000,000*l.* Such a bridge was talked about some years ago, but the interests of navigation were thought to require a span of at least 1000 metres, and, therefore, the idea was then given up. During the last year it has been revived in connection with a system of bridge building, designed by M. Boutet, a French engineer, by means of which it is thought by competent authorities the required span can be attained at a cost of 8,000,000*l.*, and with only 29 piers. The inventor of this system, indeed, professed himself able to construct by it a span very much exceeding 1000 metres, but the supporters of the project, in obedience to a suggestion of the Emperor of the French, who has taken great interest in the design, and devoted a site at one of the Government establishments, and the necessary workshops and appliances for testing its practicability, prudently determined to confine their efforts to the attainment of the required span of 1000 metres. So far as these experiments have proceeded they have been exceedingly satisfactory, and we, in common with those who are acquainted with what is doing in Paris, are looking forward with great interest to the result. M. Boutet has demonstrated that he can construct a bridge with much less material than any other existing plan of bridge building would require, and the Emperor has pronounced his project far preferable to all the other schemes which have yet been proposed. There can be no doubt that, if practicable, at the cost of 8,000,000*l.* a bridge would be better than a ferry-boat, which would not afford a continuous railway communication, and no ship has yet been constructed which is free from the motion occasioned by a rough sea; whilst, on the other hand, experience teaches that the largest vessel now afloat is liable to difficulties arising in the steering and management to which smaller ships are not subject. Pending the investigations to which we have referred, we think it is only fair to deprecate misrepresentation of a project which, at all events, has very great merit, and is well worthy of the attention it has attracted and is receiving.

DRESSING ROOFING SLATES.—The invention of Mr. R. HARRISON, of Port Madoc, relates to cutting both ends of the roofing slates at one and the same time, and to cutting the one end immediately after the other by machinery; also the cutting of both sides of the roofing slates at one and the same time, or the cutting one side immediately after the other, by machinery. By these means the inventor completes the squaring or dressing of roofing slates by two operations—that is, by passing each slate twice through the machine, or if two machines are used, then once through each machine. A second part of the invention consists in showing on the surface of a register or counter the number of finished, or partially finished, roofing slates as they pass through the machine.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XXX.—I have (said Mr. SMYTH) sketched the methods by which the shafts of mines are usually secured, so long as timber is the most suitable material for that purpose. In fact, it is by this means the greater part of those of metalliferous mines have to be secured; and reasonably so, because most of them are put down as exploratory, in ground of more or less uncertain character. When shafts are carried out on a scale like that exhibited by the longitudinal section of the great mine called the Levant, in Cornwall, and are commenced with a certainty of having to go to depths of 200 or 300 fathoms, great expense is gone to, and they are lined with brickwork. No doubt motives of economy suggest that dangerous portions of the shafts should be lined with timber for the time being, when there is uncertainty as to whether they will not be required longer than the timber will last. When, however, it is found that instead of four or five years shafts are likely to be required for twenty or thirty years, the old work had better be removed at once, and stronger timber put in. This brings us to consider the enormous cost of timbering in some cases. The statistics, indeed, of most mines will show how serious a portion of the expenditure goes for timbering, and how important in the economy of working it is that the most suitable woods should be selected, and that they should be placed in positions and under circumstances most favourable for their preservation. There are mines in the North of England in which the expense of timbering comes to 1s. or 1s. 6d. per ton on the mineral raised. I am not speaking of coal, but of minerals of greater intrinsic value. In collieries, however, the expense is very great both for props and sets for the roads and air-ways. In Cornish mines matters differ materially; but, take it all through Europe, it is a rule that where the mines are least well ventilated the destruction of timber is most rapid. It has been found that a good circulation of fresh air prevents the spread of dry rot. The presence of that destructive agent is often perceptible in some parts of a mine by the smell. In such places the timber will be apparently sound at the outside, while it is rotten right through; and it will be invariably found that the temperature there differs from other parts, arising from the ventilation being defective. When the ground is hilly and the excavations large great attention has of late years been paid to the introduction of sufficient currents of ventilation; and in other cases where the temperature is high, as in the Hartz, a systematic sprinkling with cold water is found to prevent the action of dry rot. The water is conveyed down the shaft by wooden spouts, having openings at intervals, with a kind of rose, or sometimes a mere simple orifice, through which the water is made to squirt out over the whole timber. Great attention has at different times been given to plans devised for the preservation of timber by chemical means, but many of them have been found too expensive for adoption. Others have been inconvenient, from the strong and unpleasant odour given off, but this objection may be met with an abundant supply of fresh air. Among these plans there are, no doubt, several which may be applied with facility, such as soaking the timber before it is used in strong brine, a plan extremely feasible, as it has been found in salt mines when the wood becomes incrusted with salt that it lasts a long time. Another method is to soak the timber in various sulphates, and amongst others that of copper. Where water is impregnated in this way, and can be pumped to the surface, and so reserved that the timber can be placed in it, a considerable advantage will be obtained, and it is found that it will last beyond all comparison longer than it will if not so treated. It is not often that strong sulphurets of copper can be obtained; but where they can it is natural that managers of mines should adopt preservatives of this sort, or at least experiment on the subject.

I will now pass to the modes of securing the sides of shafts. In the case of a coal mine, with a drawing shaft of moderate dimensions, it is necessary to have room at the bottom for the full carriages to run in and the empty ones to start off to the workings. If the ground is thoroughly strong, the system of merely putting in cross-pieces will suffice, at least for the entrance to the level; but when the colliery is large, and the shaft likely to be open for years, then it should be arched with stone or brick. In metalliferous mines, when it is uncertain how long drawing at that point is likely to last, and when, perhaps, a dozen levels open into one shaft, some special arrangements will have to be made. The steam-engine at the top can only attend to one or two levels at once, and meanwhile in the other levels the material is accumulating, and waiting for its turn to be drawn up, which may not be for some time. In this case the end of the level nearest the shaft will be inconveniently blocked up, and it might be that the ventilation would be interfered with. It is, therefore, necessary to provide for an accumulation (say) of a week or a fortnight by the construction of what is called a trip-plat, or an enlargement of the opening at the shaft, where the material can be stored. This is done by taking away a small piece of ground below the end of the level, the roadway or rails of which are then supported on props. The opening being below the wagon-way, the wagons can be tilted, and their contents emptied into the plat without difficulty. In tin mines a place of this kind is convenient, as it may be used so as to have one sort of mineral in one corner and another in another, a preliminary sorting, which facilitates after operations. When the ground is strong trip-plats are opened without difficulty and without much cost, but careful inspection of the rock is always advisable. It seldom happens, however, that these plats can be opened without great difficulty and risk; and the most skilful and careful men in the mine are always employed, in order that they may be constructed in that way which is most consistent with security. Of course, where a shaft is timbered a re-arrangement of the frames will be necessary, and so if lined with stone or brick care will have to be taken that the foundation, on which all above depends, be not weakened. In dealing with great shafts, such as they have in Hungary, 18 feet in length, and it is wanted to open a plat of the same length as the shaft, and with two or three places of deposit, according to the nature of the working each will come from, the operation will have to be done piecemeal, a principle of which I have spoken before. They will generally divide the space into three parts, and take out the upper and lower, leaving the middle piece solid between them. This, then, will be carefully taken out, replacing it bit by bit with timbering. Trip-plats are, therefore, a necessity, as without them it would be impossible to extract the ore to any large extent, or at least to anything like so large an extent, on account of the difficulty of supplying all the levels with separate raising machinery. Timbering is often employed to divide shafts, both vertically (when it is called bratticing) and partially by horizontal sollars, or landing places. In metalliferous mines the first, which is made of wooden planks, is done to separate the portion up and down which the men travel from those parts in which the machinery is at work. This is an arrangement which ought be rendered incumbent by Act of Parliament upon mine owners, as for want of it many fatal accidents occur. When the men travel by the same ropes which draw the material there is less danger, but if they travel by any other means they ought to be protected against substances falling down the shafts. The sollars, or platforms, are put in as resting places for the men, and as starting points for the successive lengths of ladder, and, as we shall see, a great amount of judgment is required in order that they may be properly placed, and the inclination of the ladders not too steep.

When we pass from the timbering in shafts to stone and brick work we find, again, great differences in points of practice observable in metalliferous districts and in collieries. It is naturally adopted most extensively where stone is plentiful; but in a great majority of cases this sort of work is carried for a little distance down the shaft. Thus, in Derbyshire steining is put in at the top, and as far down as the loose soil or other material extends, and is there called "collaring." This is an admirable rule, because the timbers nearest the surface are subject to greater alternations of heat and cold, of wetness and dryness, and consequently are likely to decay rapidly, and to require frequent replacing. I have known serious disasters arising from the rotting of sets of timber near the surface from such causes, and the sets having given way, chasms have been formed, which afterwards created great difficulties, all of which might have been obviated by a lining of stonework. Small shafts lined in this way stand for an enormous length of time. In the mines of Saxony the shafts are lined with very heavy masonry indeed, but it partakes of two or three different characters, according as the shafts are sunk on the lode or in the country. Indeed, the special requirements to be met are so various that the mining engineer ought to be prepared to adopt either wood or masonry as might be the most suitable. If a shaft be carried on two sides with the lode, and requires its extremities only to be supported, this is often done by sets of timber, but also very commonly by placing stone walling, or arching, at each end. Sometimes in a rectangular shaft the nature of the ground may require that all four sides should be arched, and so all the inside faces are made to curve. Sometimes rings of stone or brick work are put in at intervals, in the same way as sets of timber; and it is this principle, carried out with great accuracy, which is frequently applied to coal pits. They commence by placing strong beams across the top, substantial enough to bear the weight of the walling to be put in. The suspended masonry is laid upon pieces of wood, or frames, each forming a segment of the circle, which are usually called "curbs." These are put in with laths at the back, until they get down to a place on the solid rock from which they can begin their wall, and then they lay down a permanent curb. In former times these were made of oak, a few inches wider than the brickwork is to be, but of late they have been mostly constructed of cast-iron. The curb is put upon a bed, carefully cut out with hammer and chisel, no gunpowder being used, as that frequently leaves unseen cracks in the rock, which would have a tendency to give way when the weight came upon it. As the wall is built up, the irregular spaces between the back of it and the rock are carefully filled up with puddled clay and drystone, well wedged in. The sinking then goes on till they come down to another place which will prove a foundation for another permanent curb, which is put in as before, and the brickwork carried up to the curb above. In lengths of this kind, then, the lining is built in, bit by bit, and if the work be well done it will stand for many years, and, under ordinary circumstances, exclude all water; but where special difficulties occur other arrangements are necessary.

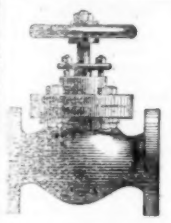
LECTURE XXXI.—In the last lecture was described the method by which stone or brick work lining was placed in shafts, under circumstances of no special difficulty, and of no unusual size; but it is obvious that the larger the area of the perforation, and the more the strata through which it passes are permeated by water, the more difficult it will be to support the ground at the back of the steining. When the shaft is very deep it is desirable in putting in brickwork to place bearers, or curbs, at intervals, and wherever suitable stone exists for this purpose it is utilised. At the base, therefore, it is the practice to put in a curb, not of wood or iron, but one of stone, and then the brickwork is built up on that, until it reaches a curb above, or right up to the surface, as the case may be. In some of the colliery districts 9-inch bricks are made for the purpose of walling shafts, by shaping them to fit the sweep of the circle, and at intervals rings of stonework are put in. This was done at the Dukinfield shaft, and more lately at Rose Bridge Colliery, which has just been completed, and, exceeding in depth the Dukinfield it, is now the deepest shaft in Great Britain. At Rose Bridge curbs, or courses of stone, are put in at every 80 yards; and in some of the old pits in the central districts of England circular brickwork is placed upon square curbs. At Shireoaks Colliery, in Notts (a section of which on a large scale was exhibited on the wall), one of the pits is lined from top to bottom with brickwork, admirably carried out in the face of many difficulties. When a shaft is sunk through watery strata, or strata through which the water percolates from other sources, then the process called "tubbing" becomes necessary. Under ordinary circumstances the presence of water in mines has always to be dealt with. When it flows down the vertical fissures of a lode it will be met with in the levels, and as we descend in depth each level will drain the one above. If, then, the water can be intercepted and cut off at a shallower point, and carried to the surface, it will be done at a less cost than if it were allowed to go to the bottom. A good deal may be done in this way, but as a rule there is a constant flow downwards, and the water will have to be pumped out at the greatest depth; and, in fact, will have to be met by pumping power, which will have to be increased as the depth of the shafts and the length of the levels are increased. Sometimes the water will come to measures, or beds, through which, being impervious, it cannot pass. This is especially the case in the coal measures, where the shales are composed of argillaceous substances, more or less impervious to water, and where it ought not, therefore, to be let into the shaft, but be cut off where it arises. If this be well done, the necessity of pumping may be obviated altogether, and leave the lower beds dry. This would be an economy which in the case of a lode is not to be thought of. It frequently happens, however, in sinking a shaft that a bed may be reached which is extremely pervious, and on which there is a great pressure. It may arise not merely from percolation from the surface, but from one of those watery strata which we call "feeders," and which the French call "niveaux." It is in such cases that tubbing comes into play, and if successful a great source of expense in the way of pumps and pumping may be avoided. This is simply finding a solid foundation below, and erecting on it a water-tight well—in other words, a tub, not to enclose the liquid within it as an ordinary tub, but to exclude it and keep it out. In those districts of the North of England where the workings are so completely dry that the workmen are incommoded with the dust, the shafts pass through strata which pour in thousands of gallons, and which require very powerful pumping machinery to be kept at work while the water is tubbed out. This is a most interesting branch of the Art of Mining; but it is only in modern times that the system of tubbing has been largely practised; probably because the older miners had not descended to so great depths, and found themselves unable to cope with extraordinary influxes of water, and so ceased working when they occurred. This operation may have to be repeated several successive times in a sinking. The material used was at the first wood, but iron is now very commonly employed. Sometimes wood will be put in for one length, and in another, where the pressure is greater, iron. When the watery beds one after another are thus tubbed out, and the bottom of the shaft has reached its proposed depth, it then becomes a question whether it is desirable to connect them all together. This is sometimes done, and then we shall find, probably, a length of 100 or 150 yards of continuous water-tight protection through the shafts. The first thing, of course, is to make the bottom joint perfectly water-tight, otherwise it might break in, and drown all below, a risk which makes it necessary to have more than one outlet for the men. There are various materials used for lining shafts. Amongst the earliest were thick planks, or solid pieces of wood, built in with stone or brick, or cast-iron, each according to the different pressures of the water having its advocate, and being followed respectively in different districts and countries. At the end of the last century wooden tubbing was common in this country, of which examples still remain, proving very useful and durable wherever the water is tolerably pure, and containing no chemical agency to corrode the iron spikes with which it was fastened. A place having been bored, where it can be done, a short wedging curve of oak is put in, and the back filled in with planks of Memel timber. On this they proceed upwards with what are called spiking curves, and the back of that filled in with broken stone. When the water is acidulous, and likely to rust the iron nails, copper nails, or spikes or pegs of iron, are used; but, generally speaking, although wooden tubbing has done good service it has given way to other systems. A method which first came into use on the Continent, and is now much used in France and Belgium, and occasionally in England, is one in which solid wood is employed. It is usual in Belgium to sink the shaft in a polygonal, or twelve-sided, form, and the tubbing is there called "cuvelage," and the wedging "picotage." They commence by putting in what is termed a "trousse coliétée," or curve, making a water-tight joint, and then on this comes a wooden curve, or "trousse picotée." Then, after a space of 3 or 4 inches, a piece of wood is put in, denominated a "land-board," and moss put in behind that. Then driving this down, the moss is driven into the interstices of the stones, into which at a latter period are also driven thin wedges, of which there will be thousands in the circumference of one shaft. They then begin to build the actual walling of solid wood, the spaces at the back being run in with concrete. A fine example of this kind of work was to be seen at St. Emile, near Maries, in the department of Du Nord, although it was afterwards the scene of a great catastrophe, carried through strata of immense difficulty. A similar formation of ground occurs in Rhenish Prussia, and in Belgium and Westphalia. A succession of chalky strata, very watery, alternate with marls, and then at the bottom a bed, nearly 300 feet thick, of what is called "courtia," full of water, and of a most difficult character. In the North of England there is a similar bed, at the bottom of the magnesian limestone, just above the coal measures, in which the miners get a rush of sand and water most difficult to contend against. In the Shireoaks district similar difficulties arose in the New Red Sandstone, now generally termed the Permian system, consisting chiefly of limes one, full of water, and requiring tubbing, throughout the whole length of the Duke of Newcastle's famous pits at that place.

Passing from this wooden tubbing, which was often successfully completed under circumstances of great difficulty, we next come to the system now mostly in use. I have already mentioned that it came into play first at the beginning of the present century, when several pits in the North of England were secured with iron tubbing. Cylinders of iron were sunk by weighting them, and digging out the soil from the interior; and then by suitable flanges, projecting into the interior, to meet the flanges of the next cylinder, sunk upon the one below, the two were firmly attached to each other by screw-bolts. This plan was open to several objections. These very large cylinders were found to be deficient in strength, which was proposed to be met by casting them in segments, with side flanges, and connected with screw-bolts, just as the horizontal joinings. It was found, however, that when the pressure came to act equally on the sides too great a stress was thrown on the flanges, which were continually giving way: and, besides which, the flanges were liable to damage from ascending and descending weights in the shaft, and the value of the tubbing constantly imperilled. Eventually Mr. Buddle, a noted colliery viewer in the North of England, introduced the system, which holds to the present day, of reversing the position of the flanges, and placing them on the outside instead of the interior, and then building up, just as before. When it happens that the pressure is very considerable a second wedging curb is put in, and filled up at the back, to make it as perfect a joint as possible; and then the plates are placed. The thickness of the plates depends upon the lengths in which the tubbing is to be put in. In some cases ¼ inch or 1 inch may serve, while in others 1¼ inch or 1½ inch will be advisable. The length of the plate, also, must be regulated by the amount of pressure to be met. If the pressure be slight, 3 feet or 2½ feet are common dimensions, but if the pressure be great the size is reduced to 1½ feet, or less.

Valuable as this tubbing is, it is subject to constant depreciation, partly from acidulous water, and in the upcast shaft from the sulphurous vapours which pass through; so that after a few years it becomes incapable of resisting the pressure it has to meet. As the cost and trouble of replacing deteriorated plates is very considerable, it is a great object to protect them from these destructive influences, and several plans have been tried, with more or less success. One of these is to build up a light wall of fire-bricks, which is a sufficient protection for the upcast shaft; and another plan, applied with less satisfactory results, is the use of certain pigments, or coatings of tar. At Shireoaks the tubbing is lined with 3-inch birch wood, in addition to a coating of tar, and that is found to answer well.

Besides the value of this mode of keeping water out of the shafts to the mine owner—saving a heavy and constant charge for pumping apparatus, and the delays and interruptions of the work incidental to those operations—it is a considerable advantage in many cases to the people who inhabit the district, inasmuch as it keeps all the waters in their accustomed channels, and prevents the springs and other supplies being tapped off and destroyed.

MOTIVE POWER.—MR. CLARK, of Chancery-lane, proposes an improved combined polydynamic motor, and the combination of the various parts, either by the aid of steam or of compressed gases generally, for driving a second fly-wheel.



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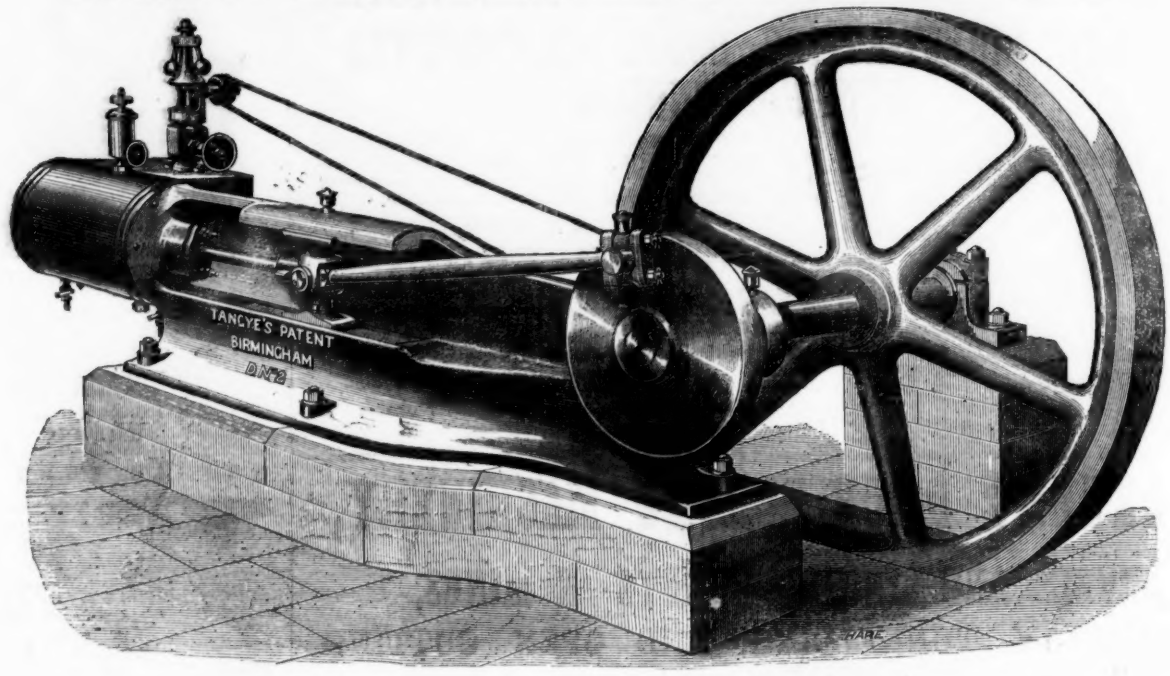

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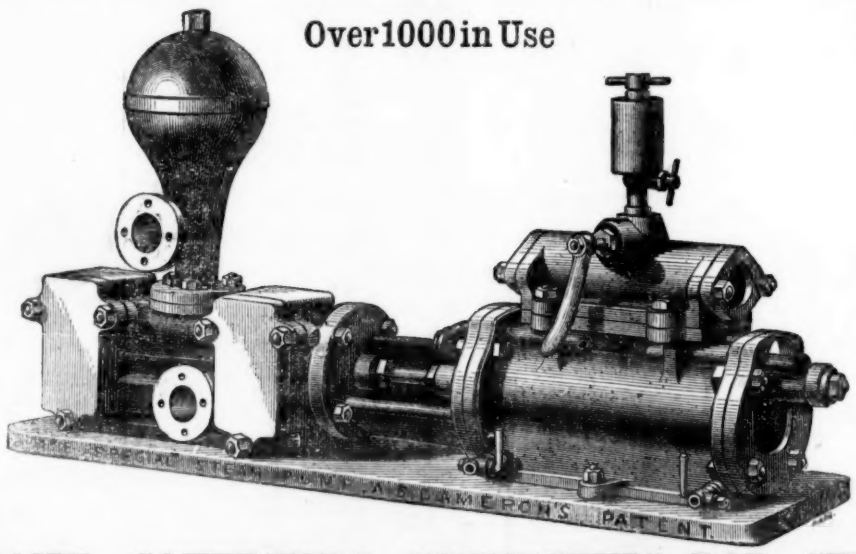

NOTE.

Requires NO Shafting, Gearing, Riggers, or Belts.

All Double-Acting.

Works at any Speed, and any Pressure of Steam.

Will Force to any Height.

Delivers a constant stream.

Can be placed any distance away from a Boiler.

Occupies little space.

Simple, Durable, Economical.

NO FLY-WHEEL, CRANK, GOVERNORS, CONNECTING ROD, GUIDE, OR ECCENTRIC.

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PRICES OF THE "SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder ..... inches	2½	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	24
Diameter of Water Cylinder ..... inches	1¼	1½	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	12	7	10
Length of Stroke ..... inches	6	9	9	9	12	12	12	12	12	12	12	12	12	12	12	12	18	24	24	24	24
Strokes per minute	100	100	75	60	50	50	50	50	50	50	50	50	50	50	50	50	35	—	—	—	—
Gallons per hour	310	680	910	2900	1830	3250	7330	5070	7330	9750	3250	7330	9500	13,000	7330	9500	13,000	—	—	—	—
PRICE	£10	£15	£20	£30	£30	£40	£47 10	£50	£52 10	£57 10	£50	£55	£65	£75	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDIN TO SIZE

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

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PORTABLE ENGINES,

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THRASHING MACHINES,

Single, Double, and Treble Blast, with Patent Rolled Steel Beater Plates, and all other Recent Improvements.

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ENGINEERS,

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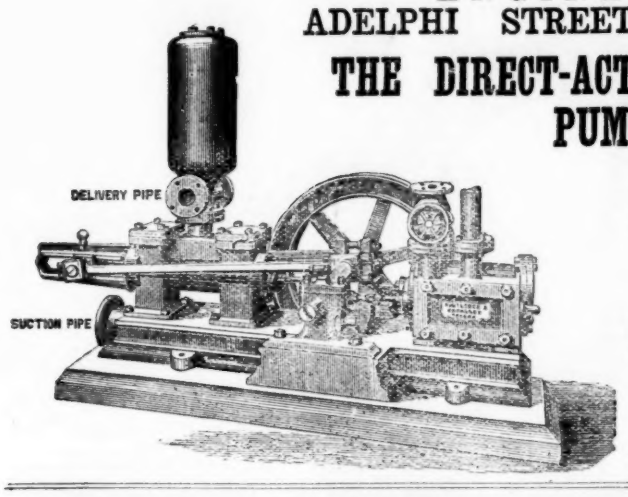
THE MAKERS OF

THE DIRECT-ACTING DOUBLE HORIZONTAL PUMPING ENGINE.



THESE PUMPING-ENGINES are especially adapted for FORCING WATER OUT OF MINES, being simple in construction and reliable. They have now been at work many years in collieries, &c., and given every satisfaction.

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Especially designed for colliery purposes; also, AIR-COMPRESSING ENGINES, as used in connection with COAL-CUTTING MACHINES, &c.

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DRIVING LEVELS AND SINKING SHAFTS IN MINES,

QUARRYING, RAILWAY TUNNELLING, AND OPEN CUTTING.

ARRANGEMENT FOR SHAFT SINKING AND QUARRYING.

In STONE of ORDINARY HARDNESS the MACHINE will BORE HOLES at the rate of about SIX INCHES in depth PER MINUTE, and in the HARDEST GRANITE at from TWO to THREE INCHES PER MINUTE. For this a working pressure of 30 lbs. only per square inch is required. In Quarrying and Shaft-sinking the stand is not required, consequently NO TIME IS LOST IN FIXING THE MACHINE.

This engine has been used with advantage in the mines of the Vieille Montagne Company in Germany, as well as in Belgium, and at Tincroft Mine, in Cornwall.

Twelve engines are now in course of construction for use in the Dolcoath Mine, in Cornwall.

For further particulars, apply to the sole makers—

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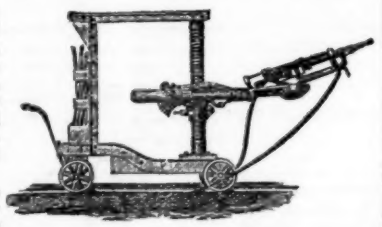
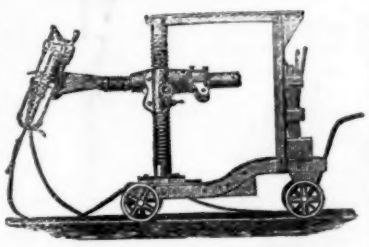
On whose premises a Machine can be seen in action.





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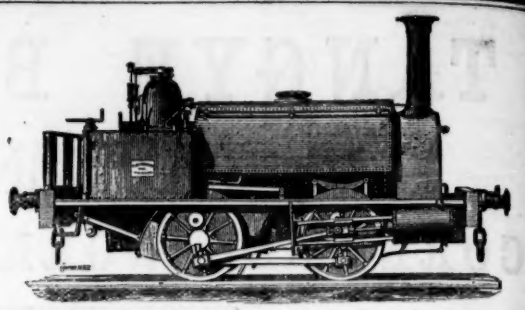

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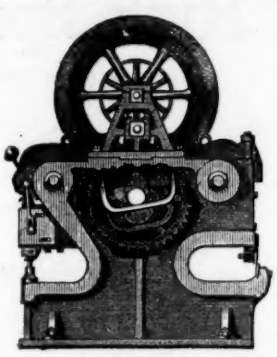

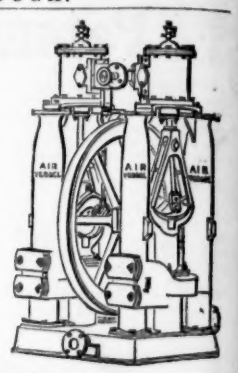

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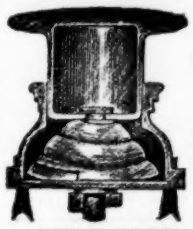

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